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ALIEN PROPERTY CUSTODIAN

HEAT RESISTING ALLOYS

Werner Hessenbruch, Hanau on the Main, Germany; vested in the Alien Property Custodian

No Drawing. Application filed February 9, 1937

The present invention relates to heat resistant alloys and to articles constructed wholly or in part thereof.

The applicant has previously found that the heat resistance of alloys which are already heat resistant and which contain as main constituents one or more metals of the iron group and in addition one or more metals of the chromium group as well as aluminum if desired, can be improved by a small addition of calcium. The calcium addition lies between about 0.05 and 2%.

Further, it has also been found that an addition of 0.02 to 1.2% of cerium is also effective in the same way. An addition of rare earth metal to heat resistant alloys for the improvement of their heat resistance is the object of applicant's U. S. Patent No. 2,067,569. This improvement of the heat resistance so operates that by the addition of calcium or cerium the time for which, at a given temperature, a heating conductor, for example, of the said material can be maintained at this temperature without burning out is greater, or with the same life period, that is to say the period until burning out, the temperature of operation with the calcium-containing or cerium-containing materials can be chosen higher. As basis alloys there may be employed, for example, the known chrome-nickel alloys with about 50 to 90% nickel, 10 to 35% chromium and iron from traces to 40%. If desired, these alloys may contain in addition one or more of the metals cobalt, molybdenum and tungsten from a small but effective amount to 20% of each, the total amount of them however not exceeding 20%, and, for example, small contents of manganese or silicon (up to about 2%). For instance, the basis alloys may contain as main constituents about 80% nickel and 20% chromium or 65% nickel, 15% chromium and 20% iron or 35% nickel, 20% chromium and 45% iron besides, for example, small contents of manganese or silicon (up to about 2%).

Further, for example, use may be made, as basis alloys, of chromium-iron-aluminum alloys, the chromium content of which varies between 9 and 35%, and the aluminum content between 4 and 12%, for example an alloy with 5 to 8% aluminium and 15 to 35% chromium, especially 30–35% chromium.

The further investigations of the applicant have now established that a more far-reaching considerable improvement of the heat resistance of such materials can be obtained when to these calcium and cerium are added simultaneously, in that either with a particular calcium content a small cerium addition is made or with a particular cerium content a small calcium content is incorporated. The additions of calcium and cerium can be between from 0.02 to 2% of each of these metals. However, the sum of the calcium and cerium should not substantially exceed 2%. It has been found that by the simultaneous addition of calcium and cerium not only the individual actions which correspond to the actions of the sum of these two additions result, but the heat resistance is still further considerably increased over the total action to be expected. In particular, by the simultaneous addition of calcium and cerium, alloys are obtained which are more readily worked up and with better yields than is the case when the same heat resistance is attained by a corresponding addition of one of the two alone. As a result of this relatively better adaptability for working up it is possible to increase to some extent the improving addition by simultaneously adding an alkaline earth metal and a rare earth metal, whereby a higher heat resistance is obtained than can be practically obtained by the individual additions.

The test of the heat resistance is conducted in a customary manner by spiralising wires of the various materials of 0.4 mm. thickness into small spirals mounting them freely in the horizontal position and then heating them to the same temperature by the passage of a current with two minutes' current on and two minutes' current off alternately, the temperature being maintained constant by subsequent regulation of the voltage. A note is made for each material of the number of hours for which it can be maintained at the stated temperature prior to burning out. This period is defined as the comparative life period at the particular temperature.

When, for example, the life period of an alloy which consists essentially of 80% nickel and 20% chromium is represented by the figure 100 then the life periods with alloys with the same basic composition but with contents of calcium and cerium are as follows:

With 0.2% calcium	600
With 0.2% cerium	157
With 0.1% calcium+0.1% cerium	857

The said alloys find use for electrical heating purposes and in particular for such purposes in which particularly high requirements as to temperature are made. They can be employed up to temperatures of 1200° C.

The following examples may be given for the composition of alloys according to this invention:

I

	Per cent
Chromium	10 to 30
Iron	0 to 50
Calcium	0.02 to 2
Cerium	0.02 to 2

Remainder substantially nickel with small additions for desoxidation or for improving the workability.

II

	Per cent
Chromium	18 to 25
Especially	18 to 22
Cerium	0.02 to 2
Calcium	0.02 to 2

Remainder substantially nickel with small additions for desoxidation or for improving the workability.

III

	Per cent
Chromium	12 to 18
Especially	14 to 17
Iron	10 to 22
Especially	18 to 22
Cerium	0.02 to 2
Calcium	0.02 to 2

Remainder substantially nickel with small additions for desoxidation or for improving the workability.

IV

	Per cent
Chromium	15 to 25
Especially	18 to 22
Iron	30 to 50
Especially	43 to 47
Cerium	0.02 to 2
Calcium	0.02 to 2

Remainder substantially nickel with small additions for desoxidation or for improving the workability.

V

	Per cent
Aluminum	4 to 10
Chromium	5 to 40
Cerium	0.02 to 2
Calcium	0.02 to 2

Remainder substantially nickel with small additions for desoxidation or for improving the workability.

Calcium and cerium are essentially given as examples. The calcium can be wholly or partly replaced by magnesium, barium or strontium, (defined as alkaline earth metals), and cerium can be wholly or partly replaced by other rare earth metals, in particular those of the cerium group or by the so-called cerium mixed metal. By cerium mixed metal there is understood the alloys obtained in commerce consisting of cerium with other metals of the cerium group.

The simultaneous additions of zirconium (up to 2%, or thorium (up to 5%) or both seem still to improve to a certain degree the workability with the same heat resistance.

WERNER HESSENBRUCH.

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ALIEN PROPERTY CUSTODIAN

METAL CASTING APPARATUS

Karl Friedrich Wagner, Friedrichshafen (Bodensee), Germany; vested in the Alien Property Custodian

Application filed February 23, 1937

My invention relates to the art of metal casting and more especially to means for casting metal in permanent metal molds which are movably mounted on a mold frame arranged in close vicinity of the smelting oven.

It is an object of my invention to provide a device adapted for use in this art, which renders the casting of metal in permanent molds more economical and efficient than was hitherto the case.

Hitherto, when casting fluid metal in metal molds, the workman withdraws the metal from the oven by means of a ladle and pours it into the mold, which is opened and closed by hand. Similarly the finished casting is removed from the mold by hand. In this mode of operation the temperature, at which the metal is cast, must be comparatively very high, since the metal must be thinly fluid. Since the metal is supplied to the mold under its static pressure, large risers and runners must be provided, in consequence of which the relation of the weight of the casting to the weight of the riser and runner becomes very unfavorable, being frequently 1:1 and in a great number of cases still more unfavorable. In consequence thereof the circulation of metal in the factory becomes altogether uneconomical. Furthermore the danger of spilling casting metal when transporting the open ladles from the smelting oven to the mold is greatly increased. The same is true of the danger of metal poured into the mold flowing over, with consequent loss of metal. In respect to readily oxidizable metals such as for instance magnesium and its alloys this mode of casting is altogether disadvantageous in view of the great deterioration of the metal.

The casting apparatus according to the present invention allows these drawbacks to be avoided by the provision that the casting metal is taken up from the melting pot by a mechanical filling device and is fed directly to the mold also by mechanical pressure through a pressure chamber under seclusion from air. The mold frame is arranged right above the smelting oven, and with the airtightly mounted covering plate of this oven the mold frame is combined into an intermediate piece forming a casing in which is arranged in an airtight manner the pressure chamber serving for feeding the metal to the mold. The metal flows under a pressure corresponding to the usual static pressure generated by a casting piston, which is preferably actuated by hand, from below directly into the mold. A riser or dead head is not required at all for the operation of this device, and the runner may be kept extraordinarily small. After removal of a slide closing the casting channel near the gate the runner may be removed directly by the casting piston before the casting is withdrawn from the mold.

The new casting device involves further the advantage of altogether secluding the metal from the air on its way from the melting pot to the mold, whereby the casting of readily oxidizable metals is rendered possible. It involves the further advantage of resulting in the production of dense, accurately shaped castings and a considerable reduction of time as compared with the casting by means of ladles.

The mold may either be movably arranged on the mold frame as in the process hitherto practised, or a special holding and mounting device may be provided on the mold frame, in which the mold is mounted.

In the drawings affixed to this specification and forming part thereof a metal casting device embodying this invention is illustrated diagrammatically by way of example in axial section.

Referring to the drawing, **1** is the smelting oven, **2** is the melting pot, and **3** is a covering plate hermetically closing the oven. **4** is the mold frame mounted on the covering plate and forming together with it an intermediate piece resembling a hermetically closed casing and being hermetically closed. **5** is the stationary part, and **6** is the part movable in the direction of the axis of the pressure chamber, of the mold mounted on the mold frame, this mold being formed with a cavity as required for the formation of the casting **7**. **8** is the pressure chamber formed in the casing, and **9** is the casting piston arranged in this chamber for longitudinal displacement. The pressure space of the chamber communicates directly with the interior of the filling chamber **11**, which extends into the body of molten metal **12** in the melting pot and is formed with a lateral opening **13**. **14** is the filling piston arranged for reciprocation in the filling chamber **11**, **15** being a lever pivotally mounted on a rod **16** and serving to actuate the piston **14** for the feeding of fluid metal into the pressure chamber **10**. The return movement of the piston **14** to its position of rest may be furthered by a spring.

The pressure chamber **10** communicates directly through the short gate **17** with the interior of the mold. On the side facing the casting piston **9** the pressure chamber **10** is closed during the casting procedure by a movable slide **18**, which at

the same time delimits the gate and can be shifted laterally by means of a lever 19.

The casting piston 9 is connected by a rack 20 with a pinion 21 which can be rotated by means of a lever 22 to reciprocate the casting piston in the pressure chamber. The movement of the piston in this chamber causes the fluid metal present therein to be forced into the mold and to be kept therein under pressure during solidification. After the casting procedure has come to an end, the slide 18 is removed and the casting piston 9 advanced farther to sever the runner at the edge 23, the runner then dropping through the chute 24 into a basket 25.

The smelting oven 1 is provided with an opening (not shown), which can be closed and through which fresh metal can be supplied to the oven. If it should be desirable, with respect to the metal to be cast or to the casting procedure as such, to maintain a uniform temperature in the pressure chamber 10 a suitable liquid or gaseous heating or cooling agent may be passed through the cavity 26 surrounding the pressure chamber 8. Whenever the nature of the casting metal should require it, the cavity 26 and the free space above the metal level in the melting pot may be evacuated or may be filled with inert non-oxidizable gases in order to prevent the casting metal to be deteriorated in contact with the air.

Obviously the field of application of the new casting device is not confined to readily oxidizable metals, and the device may advantageously be used also when casting any other kind of metals and alloys. The filling and mounting devices may also be made of materials which are not attacked by the casting metal, for instance aluminum and its alloys.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described for obvious modifications will occur to a person skilled in the art.

KARL FRIEDRICH WAGNER.

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K. F. WAGNER
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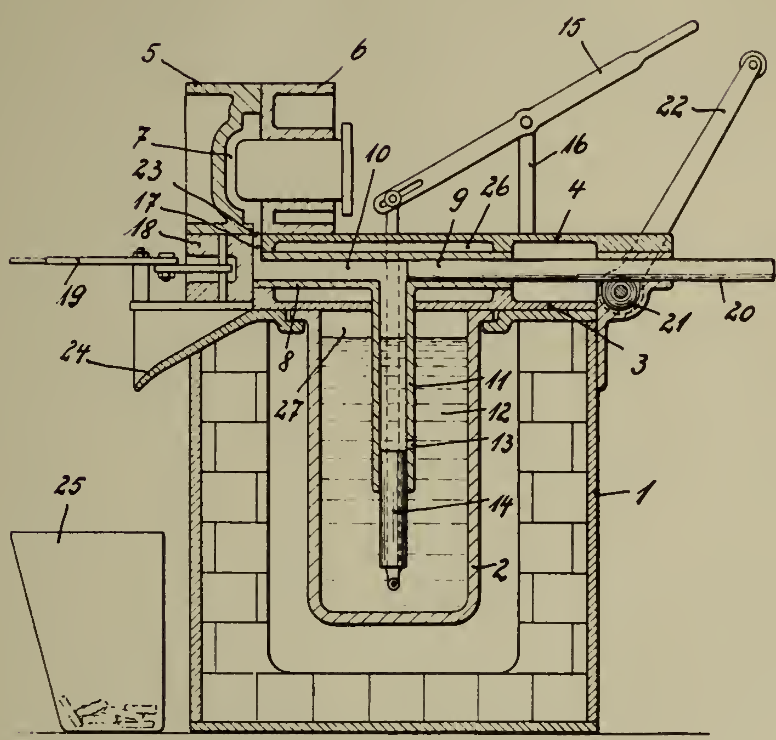

Inventor:
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By [illegible]
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ALIEN PROPERTY CUSTODIAN

SOIL IMPROVERS

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No Drawing. Application filed August 3, 1937

It has been proposed to manufacture soil improvers by maintaining materials containing a substantial amount of humin acids, hydrated silicic acid and hydrated alumina in a moist condition at elevated temperature for a period of time sufficient to produce colloidal complex compounds of humin acids, silicic acid and alumina. These complex compounds are capable of producing compounds with bivalent bases with a high interchanging power for bases, which have a very beneficial action on the soil.

I have now found that certain compounds of humin acids with alumina, preferably not less than 1%, calculated as Al_2O_3 on the dry organic matter present in the material, are very active soil improvers, especially for soils containing a substantial proportion of clay. The dispersibility of the said compounds can be increased by incorporating monovalent bases, such as sodium, potassium or ammonium.

If desired calcium and/or magnesium may also be incorporated to a certain degree, which has the effect that for instance the manufacturing process is improved as the complex compounds containing calcium and/or magnesium are easier to separate from the aqueous suspension by filtration processes.

Experiments have shown that complex compounds of the character indicated above are of great value for improving the properties of the soil. They have a favourable influence on the crumb structure and increase the active surface of the soil, owing to the fact that the size of the crumbs of the soil is materially reduced. They also increase the specific volume of the soil and have a favourable influence on the ratio of air, water and solid material within the soil. They have a retarding influence on the evaporation of the water from the soil, by promoting the formation of a dry thin layer at the surface, which prevents rapid evaporation of water from the interior.

Moreover the crumb structure in a soil, treated with a soil improver according to the invention, is more resistant against water so that the porosity of the soil, especially after heavy rains, is better maintained.

It is known in the art to produce materials rich in humin acids by subjecting fossil or recent organic materials, such as sphagnum peat, to an oxidizing process. Materials of this character also show the above mentioned favourable action on the soil to a certain extent; however, by incorporating aluminium in the said materials the soil improving properties are highly increased, so that the same effect on the soil is obtained with a considerably lower addition than in the case of aluminium free humin materials. The amount of the soil improver according to the invention required to effect the desired improvement is therefore very small which is of great economical importance.

The aluminium can be completely or partly replaced by iron.

If potassium or ammonium are used as monovalent bases the soil improvers also act as fertilizers.

The soil improvers according to the invention generally do not contain silicic acid, as the presence of silicic acid in the complex compounds has an unfavourable influence on the action of the same in soils containing clay. However, I also wish to claim products containing a certain amount of silicic acid as far as they are not covered by the patent No. ——— (application No. 717,536).

The soil improvers according to the invention are manufactured by causing products rich in humin acids to react in the presence of water with aluminium and/or iron compounds under such conditions that both the humin acids and the aluminium or iron compounds are in dissolved or finely dispersed state, preferably at an elevated temperature, so as to produce complex compounds of humin acids and alumina.

In order to explain the process which is the object of the invention I shall describe the reactions which will occur when humin acids are made to react with aluminium compounds according to the invention.

The humin acids may be produced e. g. by subjecting sphagnum peat to an oxidizing process by blowing air through the material heated to a temperature of 120° C under a pressure of 10 atmospheres and periodically or continuously introducing ammonia in gaseous or liquid form so as to maintain the pH value between 6 and 7. A process of this character has been described in Patent No. ——— (Application No. 717,536). The humin acids are now separated from the oxidized material by extracting the same with aqueous ammonia, acidifying the solution and washing the precipitate.

The humin acids obtained in this way are dispersed in water and ammonia is gradually added so as to produce a dispersion having a pH of 7. To this dispersion I slowly add a solution of aluminium sulphate, preferably at a moderately elevated temperature, the amount of aluminium sulphate added being about 2½%, calculated as

Al_2O_3 on the dry organic material. By this addition the pH is lowered from 7 to about 5 and the liquid becomes gelatinous.

When I now add sulphuric acid until the pH is decreased until about 4,3 a complex compound of humin acid and aluminium hydrate is produced in flocculated form. This complex compound can be separated from the liquid by filtering and I have found that it holds the aluminium so firmly bound that it can only be dissolved out by washing the substance with strongly acid solutions having a pH lower than 2 or with strongly alkaline solutions.

If during the reaction of the humin acids with aluminium sulphate the pH is allowed to decrease below 4, e. g. by adding a larger amount of aluminium sulphate, e. g. 5%, calculated as Al_2O_3, the mixture has a too strongly acid reaction to maintain the humin acids in finely dispersed condition and in the resulting products the aluminium will not be firmly bound. This is proved by the fact that a great part of the aluminium will already be dissolved when extracting the solid material with weakly acid solutions, e. g. solutions having a pH of 2½–4.

On the other hand complex compounds containing the aluminium in firmly bound condition will be obtained when after adding e. g. 2½% alumina in the form of aluminium sulphate the pH value is increased until about 7 by adding ammonia and then the remaining 2½% of the aluminium sulphate is added.

I shall now describe the process of manufacturing soil improvers according to the invention as it is carried out for technical purposes.

The aluminium compound is generally added in the form of a soluble salt, e. g. aluminium sulphate or aluminium chloride. I may also use aluminium hydrate in a finely dispersed form; e. g. in gel form; however in this case it is not possible to carry out the reaction at elevated temperature as the aluminium hydrate has the tendency to flocculate and to lose the high degree of dispersion necessary for the present purpose when heated.

A suitable starting material for practical purposes is a solution of aluminium ores e. g. of bauxite or clay, in sulphuric acid.

The humin acids are generally not used in isolated condition, but in the form of the material obtained by subjecting certain organic materials to an oxidizing process.

According to an embodiment of the invention the humin acids are produced, either before, during or after the addition of the aluminium compounds, by subjecting fossil or recent organic materials to an oxidizing process by blowing air through the material in moist condition at a temperature not substantially exceeding 130° C. The proportion of humin acids produced can be increased by maintaining the pH value during oxidation below 9, preferably between 6 and 7. This regulation of the pH has a very favourable influence on the oxidation and polymerisation processes of the substances present in the peat so that humin acids of the desired properties are obtained.

The pH is controlled by periodically or continuously introducing alkaline substances, such as ammonia in gaseous or in dissolved form. This treatment should preferably be continued until the absorption of oxygen by the material is practically finished, as the products obtained in this way have proved to be very resistant against bacterial oxidation in the soil.

A suitable starting material for producing humin acids by the aforementioned oxidizing process is sphagnum peat and the invention will be illustrated by examples in which sphagnum peat is used. However, other recent or fossil organic substances are also suitable, e. g. straw, paddy straw, refuse of sugar factories (bagasse and pulp), lignite and charcoal.

The material rich in humin acids which is produced by the processes described above is so treated as to bring the humin acids into finely dispersed condition. This is effected by increasing the pH to about 7, preferably by adding ammonia and heating the mixture to a temperature of e. g. 60° C. The mixture may have the form of an aqueous suspension and in this case it will contain e. g. 5 parts by weight of water on 1 part by weight of dry organic substance; however, it may also be a solid, relatively dry mass which contains e. g. 2 parts by weight of water on 1 part by weight of dry organic substance. Preferably the consistency of the reaction mixture should be such that it can be easily stirred.

The material containing the humin acids in finely dispersed condition is now made to react with the aluminium salt solution, e. g. an aluminium sulphate solution and, as pointed out above, care should be taken that the pH value of the reaction mixture remains within the range of pH values necessary for maintaining the humin acids in finely dispersed condition. The pH generally should not decrease below a value of about 4,8.

According to an embodiment of the invention the pH value of the reaction mixture is maintained between 4 and 8 by alternately adding an aluminium salt solution and an alkaline substance, preferably ammonia. By way of example I may mention that by adding 2½% of alumina in the form of aluminium sulphate the pH is generally lowered to about 5. By adding ammonia I increase the pH to about 7 with the result that the colloidal substances are finely dispersed again. I can now add a further quantity of aluminium sulphate solution, e. g. corresponding to 2½% of alumina, without risking the pH value to be lowered substantially below 5.

When the desired complex compound has been definitely formed, the aluminium is firmly bound and the pH may now be lowered as far as 2 without the danger of dissolving out part of the aluminium. However for obtaining a product which can be easily separated from the aqueous liquid by filtration it is sufficient to adjust the pH to a value of about 4½–5.

After filtration the pH value of the final product is advantageously adjusted between 6 and 8, preferably at about 7 so as to obtain a soil improver which can be easily dispersed in water.

The oxidizing process of the organic starting materials can be effected before, during or after the treatment with the aluminium compound, but it is preferred to carry out the oxidizing process first and then to add the aluminium compound.

The binding of the aluminium in the complex compound and the colloidal properties in general of the oxidized and polymerized product may be improved by treating the organic material before the oxidizing process with water, preferably acid or alkaline and preferably at elevated temperature.

When using an acid or alkaline liquid for this treatment the mixture, if desired, may be washed with water before subjecting the same to the oxidizing process. The treatment with water or

dilute acid or alkali can also be effected after the oxidizing process but before the addition of the aluminium compound. In this case too the treatment is preferably effected at elevated temperature and the mixture may be washed with water before adding the aluminium compound. A distinct improvement is e. g. already obtained by heating the reaction mixture after the oxidizing process with water, whereas the same treatment before the oxidizing process gives less satisfactory results. It is not improbable that the organic material or the oxidized and polymerized organic material contains derivatives of reducible sugars which enter into the complex aluminium compounds and have an unfavourable influence on the binding of the aluminium in the same, so that it can be expected that a treatment of the organic material which tends to remove the said sugar derivatives or to convert the same into harmless or even useful substances will improve the properties of the final product.

According to a further embodiment of the invention calcium and/or magnesium are incorporated into the complex aluminium compounds by adding calcium and/or magnesium compounds before, during or after the reaction between the material rich in humin acids and the aluminium compound. A product containing calcium can be obtained e. g. by neutralizing the product obtained by the reaction with aluminium sulphate partly with calcium hydrate and partly with ammonia.

The soil improvers obtained according to the invention can be easily dispersed in the soil. They have a favourable influence on the crumb structure and improve the aeration of the soil and retard the evaporation of the water from the same. The remarkable influence of the complex aluminium compounds according to the invention on the size of the crumbs can be shown by the following test:

Finely pulverized clay is mixed in a suitable vessel provided with a stirring device with 15–35% of water, dependent from the material used. Owing to the plastic condition of the clay particles aggregates are formed which can be compared with the crumbs in the soil and which under predetermined conditions attain a certain size. I have now found that by adding a small amount of the soil improver according to the invention the size of the crumbs is materially reduced.

The amount of the complex aluminium compound required is very small. In several tests I have found that an addition to the clay of e. g. 0.1% of the technical soil improved (corresponding with about 0.07% of dry organic matter) is sufficient to obtain the optimum value for the reduction of the size of the crumbs. However this value is only mentioned by way of example as it will obviously be dependent from the character of the soil to be improved and the soil improver used.

The invention will be further explained by the following examples:

Example 1

In an autoclave provided with a suitable stirring device 1½ kilograms of sphagnum peat (containing about 20% of water) and 0.9 litres of water are heated at a temperature of 125–130° C and a pressure of 10 atmospheres. Air and ammonia are introduced into the autoclave.

The amount of air is about 400 litres per hour and the amount of ammonia is controlled so as to maintain the mixture substantially neutral or slightly acid (pH5–7, 6–7). This can be attained by gradually reducing the amount of ammonia introduced during the reaction which takes about 8 hours. In the beginning gaseous ammonia is introduced in an amount of 75 litres per hour and I finish with small amounts of ammonia, which are preferably added in the form of a solution by means of a sluice device.

The product obtained in this way is mixed with a suitable amount of water so as to obtain a mixture which can be easily stirred. It is adjusted at a pH of about 7. I then slowly add a dilute aluminium sulphate solution, the mixture being continuously stirred and maintained at a temperature of 60° C or higher. This step can also be carried out in the autoclave.

The total amount of aluminium salt added to the mixture is about 5%, calculated as Al_2O_3 on the dry organic material.

The addition of aluminium sulphate is preferably carried out in stages, by first adding aluminium sulphate until the pH value has been lowered to about 5; this is the case when one half of the aluminium sulphate has been added. I now increase the pH value again till about 7 by introducing ammonia and I then slowly add the other half of the aluminium sulphate solution with stirring. The finel pH value is 4.5–5. Calciumhydrate can be added if desired in this stage.

The reaction mixture is left to stand for some time. The soil improver settles down from the solution and is separated from the supernatant clear liquid. If desired the produot can be made slightly more acid. It can be dewatered in a filter press or a continuous filter, and subsequently can be dried.

The product obtained has a too strongly acid reaction to be readily dispersible and it is therefore brought at a pH of 7 by adding ammonia. If a product containing calcium is desired neutralisation is effected partly with ammonia and partly with calciumhydrate, one third of the free equivalents being saturated by calcium and two thirds by ammonia.

The product is easily dispersed in the soil where it improves the crumb structure and in connection therewith the aeration. It also has a favourable influence on the behaviour of the water in the soil.

Example 2

The process is carried out in the same way as in example 1, but after the oxidizing process the reaction mixture is boiled with water for about 2 hours. It is then converted into the complex aluminium compound after the method described in example 1.

Example 3

This example refers to a process in which the incorporation of the aluminium compound and the production of humin acids are carried out simultaneously. The oxidation process corresponds to that of example 1 with the following difference:

The sphagnum peat is boiled for six hours with a solution of 2.5% HCl, filtered and washed. The aluminium sulphate solution is slowly added by means of a sluice device. The addition of this solution is started after an oxidation period of two hours, according to example 1. Half of the aluminium solution is added in about 15 minutes. During the whole process the mass is energetically stirred so that a thorough mixture is ob-

tained. After the addition of the aluminium sulphate ammonia is added until the mixture (which has been rendered acid by the aluminium sulphate) is practically neutral.

I then continue the oxidizing process. After the third hour I again add aluminium sulphate and neutralise again with ammonia. The oxidation process is further carried through as described in example 1.

The total amount of aluminium sulphate added in this example may, for instance, amount to about 2.5 parts by weight of Al_2O_3 on 100 parts by weight of dry organic material.

Example 4

In this example the starting material for the oxidizing process consists of sphagnum peat treated with dilute acid at elevated temperature, so as to invert and to remove the reducible sugars. The sphagnum peat ordinarily used yields about 13–18% of reducible sugars. Removal of the sugars is effected by boiling the peat with dilute hydrochloric acid (2½%):

1000 grams of sphagnum peat treated as described above and still containing 1,9% of reducible sugars are mixed in an autoclave with 667 grams of water. The autoclave is heated to a temperature of 120° C and 340 litres of air per hour are blown through the reaction mixture. The pH is maintained between 6 and 7 by introducing ammonia (30%) by means of a sluice device.

The product is then adjusted at a pH of 7. Water is added in an amount of 2 parts by weight on 1 part by weight of dry organic material. A dilute solution of aluminium sulphate is now slowly added in an amount corresponding with 2.5% of Al_2O_3, calculated on dry organic matter.

The final product is adjusted at a pH value of 7.

Example 5

The oxidizing process is effected in the same way as in example 1.

After the oxidizing process the product is washed with hydrochloric acid (2½%) and filtered. In the beginning the filtrate is coloured. The washing is continued until the filtrate is practically colourless. The product is treated thereafter as in example 1 as concerns the addition of aluminium.

Example 6

The oxidizing process is effected in the same way as in example 1. The oxidized product is mixed in the autoclave with water so as to obtain a suspension containing 4 parts by weight of water on 1 part by weight of dry organic matter.

Ammonia is added so as to increase the pH to 9 and the product is then heated at 120–130° C during six hours.

The product obtained in this way is treated with an aluminium sulphate solution according to the processes described in one of the preceding examples and the complex compounds obtained thereby contain the aluminium in firmly bound condition.

NIKOLAAS HENDRIK
SIEWERTSZ VAN REESEMA.

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ALIEN PROPERTY CUSTODIAN

METHOD FOR THE STARTING OF INTERNAL COMBUSTION ENGINES DRIVING SCREWS, BLOWER BLADES OR OTHER ROTATING MASSES

Reinhold Freitag, Stuttgart-Unterturkheim, and Will Stoeckicht, Solln bei Munchen, Germany; vested in the Alien Property Custodian

Application filed October 6, 1937

In the driving means for screws hitherto known the shaft of the screw is coupled to the engine shaft either directly or by a few gear wheels and at starting the starter is caused to act directly upon the engine shaft.

In contrast thereto the present invention resides in a method for the starting of internal combustion engines driving screws, blower blades or other rotating masses according to which the starter is caused to act upon the uncoupled screw shaft and the screw shaft is coupled to the engine shaft only when so much energy of rotation has been accumulated in the mass formed by the screw shaft and blades that this is capable of turning over the internal combustion engine. This method may also be applied in such fashion that the starter is first caused to act upon the uncoupled screw shaft and somewhat later, immediately before the coupling thereof, also and at the same time upon the engine shaft.

By this new starting method, not only the starter but also the parts to be driven are greatly spared because the transmission of the starting forces and also the initiation of the drive from the engine take place extremely gently. In particular the starter clutch is subjected to no such high wear as hitherto and the starter clutch does not need to be repeatedly renewed. Also it is possible to employ a considerably smaller and simpler starter than hitherto which again represents a saving of weight and starting energy.

An arrangement for carrying out the method in accordance with the invention is illustrated in the drawing in two embodiments by way of example:

Figs. 1 and 2 show two different forms of construction of an airscrew drive in longitudinal section,

Fig. 3 is a detail illustration of a braking device in side elevation and section and

Fig. 4 a self acting dog clutch in longitudinal section and detail illustration.

In Fig. 1 a driving engine-shaft 1 and an airscrew shaft 2 to be driven are located coaxially one behind the other. The two shafts have each a flange-disc 3 or 4 and, near the edge of each flange-disc, Fig. 1 shows a pin 5 or 6 of which there are about six in all. Each of the pins carries a planet wheel 7 or 8. For these planet wheels 7, 8 there is provided a common sun-wheel body 9 which bridges both the axial distance and also the radial distance between the same in such fashion that the planet wheels 7 engage in internal teeth 10 and the planet wheels 8 in external teeth 11. The sun-wheel body 9 has generally the shape of a bell and is mounted in freely rotatable fashion on the shaft 1. The planet wheels 7 also engage with a pinion 12 which is likewise mounted freely on the shaft 1. Also freely mounted on the shaft 1 and rigidly connected to the wheel 12 is a braking drum 13 whose braking band 14 (Fig. 3) can be tightened or loosened by a lever 16 swingable about a pivot 15. Engaged with the lever 16 is the rod 17 of a piston 18 which slides in a cylinder 19 and is influenced on the one hand by oil pressure (20) and on the other hand by a spring 21. The oil flows to the chamber 20 in front of the piston through a passage 22 in which a throttling and closure valve 23 is included. A return passage 24 branches from the valve 23. The valve 23 can be adjusted by a lever 25 in such fashion that the oil flow from the passage 22 to the oil chamber 20 is either cut off completely or is only throttled to such an extent that the oil pressure suffices to overcome the stress in the spring 21 and forcibly to tighten the braking band 14. The excess oil then flows through the passage 24 back to the place from which it was taken. Finally the sun-wheel body has a further ring of external teeth 26 in which a toothed wheel 27 engages. The wheel 27 is in turn in engagement with a toothed wheel 28 which is mounted on the shaft of a liquid pump 29 which supplies pressure oil through the passage 22 to the cylinder space 20 in front of the piston 18. At the end of the pump shaft there is also mounted a clutch-half 30 in the vicinity of a corresponding clutch-half 31 of a starter 32. Finally there is also provided a further stationary toothed ring 33 with internal teeth in which the planet wheels 8 roll. Also a clutch-half 34 (Fig. 4) is provided on the end of the engine shaft 1 towards the airscrew shaft 2. The complementary coacting half 35 is mounted slidably in the sun-wheel body 9 in such fashion that it moves against the clutch-half 34 and engages immediately the sun-wheel body 9 rotates more slowly than the engine shaft. For this purpose the clutch ring 36 carrying the dog teeth 35 is mounted, non-rotatably but guided by grooves 37 parallel to the principal axis, in axially movable fashion on the sun-wheel body 9. On the outside of the clutch ring 36 is a ring of inclined grooves or a kind of flat thread-teeth 38 which engage in corresponding teeth 39. The teeth 39 are cut in a bushing 40 which is pressed with a frictionally tight fit by a spring 41 against a recess 42 in the engine shaft 1.

The manipulation and the manner of opera-

tion of the arrangement in accordance with the invention is as follows:

As starter 32 there is provided a fly wheel starter of such construction that as long as this is actuated or this alone is the driving part its clutch-part 31 is in the engaged position and when it has fulfilled its purpose it springs again into the disengaged position.

Upon actuation of the starter 32, therefore, the clutch parts 30, 31 come into engagement and the wheel 28 together with the pump 29 is set in rotation, for example in the clockwise direction. Consequently the intermediate wheel 27 rotates in the opposite direction and the sun-wheel body 9 in the same direction. Consequently the planet wheels 7 also rotate in the clockwise direction and the toothed wheel 12 mounted freely on the shaft 1 in the opposite direction, provided that the brake is not applied as is initially the case at starting. The wheels 7 and 12 rotate idly and the engine shaft 1 remains initially unaffected. The sun-wheel body 9 also drives the planet wheels 8 which rotate counter-clockwise and roll on the stationary ring of teeth 33. By this means the pivots 6 of the planet wheels 8 are carried along in the clockwise direction and the screw shaft 2 likewise rotates in the clockwise direction and thus, due to the rotary mass constituted by the airscrew blades, the flange-disc 4 and the other rotating gear parts, accumulates a considerable kinetic energy.

The liquid pump 29 also commences to rotate at the same time as the gear wheel 28 and, with the valve 23 open, supplies pressure oil through the passage 22 to the chamber 20 in the cylinder 19 with the result that directly after the airscrew shaft has received a first powerful driving impulse, the piston 18 is displaced to the right against the force of its spring 21 and consequently the braking band is tightened, that is the wheel 12 is braked and brought to rest. As a result the planet wheels 7 driven by the sun-wheel body 9 and rolling on the now stationary wheel 12—acting at their pivots 5—also set the engine shaft 1 in rotation and this likewise in the clockwise direction.

The power transmitted from the starter 32 to the engine shaft 1 then increases in the same measure as the rapidly and steadily increasing braking force on the drum 13. On the other hand the loading on the starter 32 also increases until finally it is no longer capable of driving the gearing and the engine and its rotation commences to become slower. Consequently, working backwardly, the rotating aircrew shaft 2 and the parts rotating with it also commence to give up their stored energy to the engine shaft so that now a driving force both from the starter and also from the airscrew shaft becomes effective upon the engine shaft and this turns over the engine before the action of the starter falls off appreciably. At the instant at which the engine responds, the engine shaft takes over the drive of tne gearing and airscrew shaft which, in accordance with the example shown in Fig. 1, may take place through two transmission stages depending upon whether the brake is tightened or released.

With the brake tightened, the sun-wheel body 9 rotates more quickly than the engine shaft 1. The clutch 34, 35 remains in its disengaged position since the frictional force between the shaft 1 and the friction bush 40 (Fig. 4) acts through the teeth 38, 39 upon the clutch ring 36 in such fashion that the latter retains its right hand end position. In this position of the clutch 34, 35 a drive of the screw shaft 2 takes place through the transmission of the planet gearings 7, 10 and 8, 33.

By moving over the valve 23 by the lever 25 (Fig. 3), however, it is also possible to cause the liquid arriving through the passage 22 to flow into the passage 24 and thereby to remove the oil pressure from the piston 18. The spring 21 then expands and displaces the piston 18 into such an end position that the braking band 14 is released and the braking drum 13 can rotate with the wheel 12. From this instant on, the planet wheels 7 and the clutch wheel 12 also rotate idly with the result that the hitherto higher speed of the sun-wheel body 9 as compared with the speed of the engine shaft 1 falls off and the sun-wheel body therefore rotates more slowly than the said shaft. The result of this is that the frictional pressure in the clutch 34, 35 is converted at the inclined teeth 38, 39 into a push which displaces the clutch ring 36 to the left and the clutch 34, 35 then engages. By this means the engine shaft 1 and the sun-wheel body 9 are rigidly connected together. Consequently the two elements rotate at the same speed. The planet wheels 7 and the wheel 12 rotate idly therewith and the engine shaft 1 drives the screw shaft 2 through one transmission only, the teeth 11 and planet wheels 8.

Upon renewed tightening of the brake by a reversal of the valve 23 in such manner that the full oil pressure can again act on the piston 18 the original condition directly after starting is again established in that a negative drive by way of the planet wheel gearing 7, 10 is again established and consequently the sun-wheel body 9 tends again to rotate more quickly than the engine shaft so that the clutch 34, 35 is again disengaged.

Fig. 2 shows how a further transmission can be interposed between the sun-wheel body 9 and braking drum 13. In this example the toothed ring 10 does not engage directly with the wheel 7 but with a smaller wheel 7*a* arranged in front thereof and rigidly coupled therewith. In order to obviate the greater constructional length necessitated by the inclusion of the wheel 7*a* the braking ring of the drum 13 is in this example directed towards the bell 9. Otherwise the arrangement in accordance with Fig. 2 operates precisely as does that of Fig. 1. Within the scope of the invention, the brake may be constructed in any desired fashion. In place of the band brake, a liquid brake, a pneumatic brake or an electric brake or any other sutiable clutch device may be provided. The particular construction of the overrunning clutch between the engine and propeller shaft may likewise be as desired. In some cases, the over-running clutch may also directly connect the two shafts. Also, within the scope of the invention, the number of planet wheels and the choice of the transmission between starter and gearing and between sun-wheel body and shafts are left free. The gearing of the arrangement in accordance with the invention need not essentially be constructed as planet gearing. The manipulating members for the starter may be coupled with the manipulating member for the valve 23 in the passage 22 so that both devices can be actuated by a common main manipulating member.

The pump 29 either draws its oil from a separate vessel or it is connected to the lubricating

oil circulation of the engine. Pressure oil may also be replaced by pressure water, for example cooling water. In the case of the adaptation of the brake for another operating medium, the pump 28 is, naturally, replaced by a suitable pressure-or current-producing device. If an electrical arrangement is provided, the braking current may also be taken from the starter circuit. The braking device may also be designed so that the braking band is tightened from two ends.

The provision of the subject of the invention is particularly advantageous for the drive of a variable pitch propeller because with such an arrangement the blades of the airscrew may be set right back at starting and the braking effect of air resistance at starting limited to a minimum value. Consequently the inertia energy of the airscrew set in rotation can be fully utilised at starting.

The invention may also be employed for the driving of rotary masses upon travelling or stationary engines.

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PUBLISHED

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METHOD FOR THE STARTING OF INTERNAL COMBUSTION ENGINES DRIVING SCREWS, BLOWER BLADES OR OTHER ROTATING MASSES

Filed Oct. 6, 1937

Serial No. 167,568

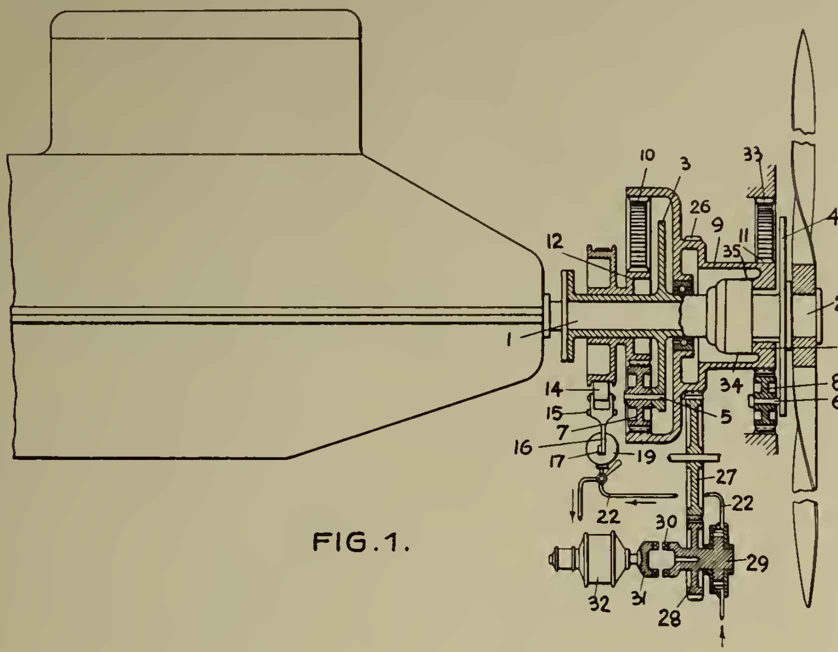

FIG. 1.

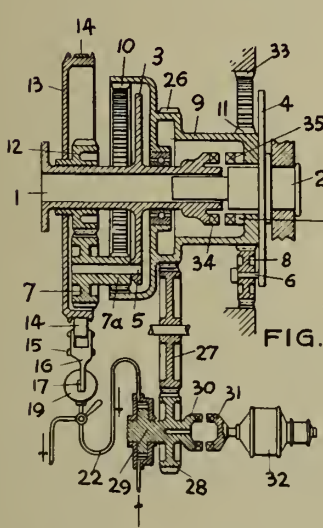

FIG. 2.

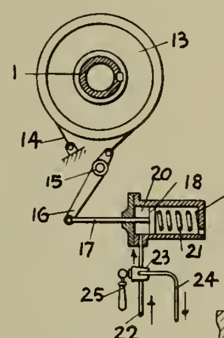

FIG. 3.

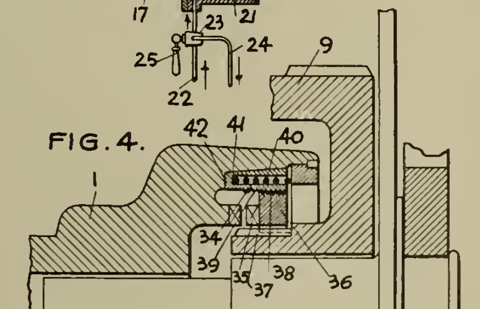

FIG. 4.

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ALIEN PROPERTY CUSTODIAN

OSCILLATION DAMPING MEANS

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Application filed November 30, 1937

My invention has for its object devices adapted to eliminate or to reduce the vibrations in machine parts submitted to disturbing, chiefly periodical, forces. More particularly these devices are adapted to eliminate or to reduce the flexional oscillations or transversal vibrations of shafts, said oscillations or vibrations appearing alone or together with other oscillations or vibrations such as torsional oscillations of the shaft considered.

These devices are based on the use of auxiliary centrifugal pendular masses, the centrifugal forces being produced by the rotation of the shaft on which are mounted the movable masses. The auxiliary masses may rock in a manner such that their speeds of oscillation have a component parallel to the axis of the shaft and, to this end, the auxiliary masses may rock in planes parallel to the axis of the shaft or passing through same, or oblique with reference to said axis. The auxiliary masses may also rock after the manner of spherical pendulums or pendulums oscillating in space.

Under such conditions, the movements of the auxiliary masses may oppose different vibrations in the machine parts and chiefly flexional oscillations of the shaft, or else simultaneously, torsional and flexional oscillations of said shaft.

I have proved it is of essential interest to make use of auxiliary solid masses, which are not submitted to elastic action, such as the action of springs nor to frictional action, and which are moreover entirely free.

It is often of advantage for the movements of the auxiliary masses to be a rolling motion. In fact, the auxiliary masses may themselves form rolling parts rolling directly on races integral with the shaft generating the centrifugal forces.

These races may show a simple or a double curvature and the auxiliary masses may move without sliding on their races after the manner of pendulums in space.

It is of interest for obtaining the maximum efficiency against periodical disturbing forces, to provide certain constructional conditions which are substantially equivalent for the auxiliary centrifugal masses to conditions of resonance with reference to the disturbing forces.

In other words, the system of auxiliary masses must, under the action of centrifugal forces, have natural periods such that at least one of them has a value at least approximatively equal to one at least of the periods of the disturbing forces. Generally speaking, the auxiliary masses may have any shape. However, when rolling auxiliary masses are used, their rolling surfaces, directly carried by these masses, are advantageously surfaces of revolution and, in particular, cylindrical or spherical surfaces.

More particularly, the auxiliary masses or certain of them may be completely formed by bodies of revolution and, in particular, by cylinders or spheres.

If the shaft generating the centrifugal forces carries races on which the auxiliary masses roll, these races are advantageously of cylindrical shape and may, for instance, be ring-shaped or else they may form spheres or portions of spheres.

I may also use movable ring-shaped masses cooperating advantageously with cylindrical races or else spherical or ball-shaped movable masses cooperating with spherical races.

In accompanying drawings, Fig. 1 shows diagrammatically a half cross-section of an arrangement adapted to reduce the vibrations of machines and more particularly flexional oscillations of shaft 1 having an axis 0.

Fig. 2 is a corresponding view of a modification and Fig. 3 is a cross-section of the same perpendicular to the plane of Fig. 2.

Fig. 4 shows how a plurality of such arrangements may be mounted on a shaft.

Fig. 5 is a diagrammatic view relating to the case where two identically shaped interconnected masses are equilibrated with reference to their axis of rotation and move in a plane oblique with reference to a shaft 1.

Fig. 6 shows the mounting on a shaft of several rolling masses moving in planes oblique with reference to the axis of the shaft.

As shown in Fig. 1 a mass 6 may oscillate while it rocks on an incurved race, which may in fact show a double curvature the concavity of which is directed towards the shaft. The mass may rock in a main direction incurved in the direction of the shaft and lying approximately in a plane parallel to the axis 0 of the shaft 1 or else in a plane containing this axis. The mass may however also execute at the same time different movements in different directions and in particular a pivotal motion around its own axis. I obtain thus an arrangement adapted to reduce flexional oscillations. The mass 6 is shown by way of example as a ball. It may produce, during oscillation, varying torques with reference to the virtual axis S_1 and if the proportions are suitably chosen with reference to the conditions of resonance, these torques may act against the causes which have a tendency to produce transverse oscillations of the shaft.

The mass 6 acting as a pendulum in space or a spherical pendulum may be efficient both against flexional and torsional oscillations of the shaft 1.

In the case of Fig. 2 the oscillating system which protects the shaft 1 against periodical disturbances of period T, comprises an inner guiding stubshaft carrying a part showing a substantially torus-shaped surface 4 having a double curvature. This part guides a ball 6 rolling under

the action of the centrifugal forces over the outer double curvature surface **5**. These elements are shown in section in Fig. 3. Washers prevent the ball from escaping laterally.

Fig. 4 relates to the case where a certain number of devices similar to the device just mentioned are arranged along the shaft **1** at distances l_1, l_2 . . . from one another, which distances may be equal or not. These devices give the shaft a sort of centrifugal rigidity similar to the well known gyroscopic rigidity.

I have shown in Fig. 4, the double curvature races **5**, the balls **6** and the inner guiding surfaces **4**. The different members are secured through keys **3** to the shaft **1**.

Fig. 5 shows two equal masses M_3 and M'_3 rigidly secured together and adapted to oscillate along the circle **9** the radius of which is r_3, to either side of their position of equilibrium under the action of the centrifugal forces generated by the rotation of the shaft **1**. The normal O'_3w to the circle **9** at its center O'_3 forms an angle λ_3 with the axis O'_3x_3 parallel to the axis XX' of the shaft **1**. I will suppose $\overline{O_3O'_3}=R_3$, $O_3O'_3$ being perpendicular to XX'.

The frictional stresses being supposed negligible, I have shown analytically the optimum or tuning condition is:

$$\frac{W}{u'}=\sin\lambda_3$$

u' being the angular speed of the shaft **1** and w the pulsation of the disturbing torsional torque acting on shaft **1**.

For eliminating certain disturbances, it is of advantage to use movable masses according to invention which are adapted to rock inside a tube the axis of which is arranged obliquely with reference to the axis of the shaft the rotation of which generates centrifugal forces.

Fig. 6 shows such a tube **23** in horizontal projection with the stubshafts **26—27—28—29** contained therein. These stubshafts guide respectively the balls **30—31**, the tubular roller **32** and the solid rollers **33**.

The tube is closed by washers or partitions **34** and **35**.

Obviously the different systems described may be arranged at any points of the shafts to be protected against irregularities of angular speeds or vibrations.

Thus, for instance, a flywheel provided with such devices may, in an automobile motor, be placed in front of the motor, near the starting crank or else near the clutch at the point where the shaft passes out of the motor or else in the middle of the motor.

However for an efficient elimination of the oscillations of the crankshaft, it is often of interest to place the different arrangements according to my invention near the points where the oscillations arise, i. e. near the head of each connecting rod.

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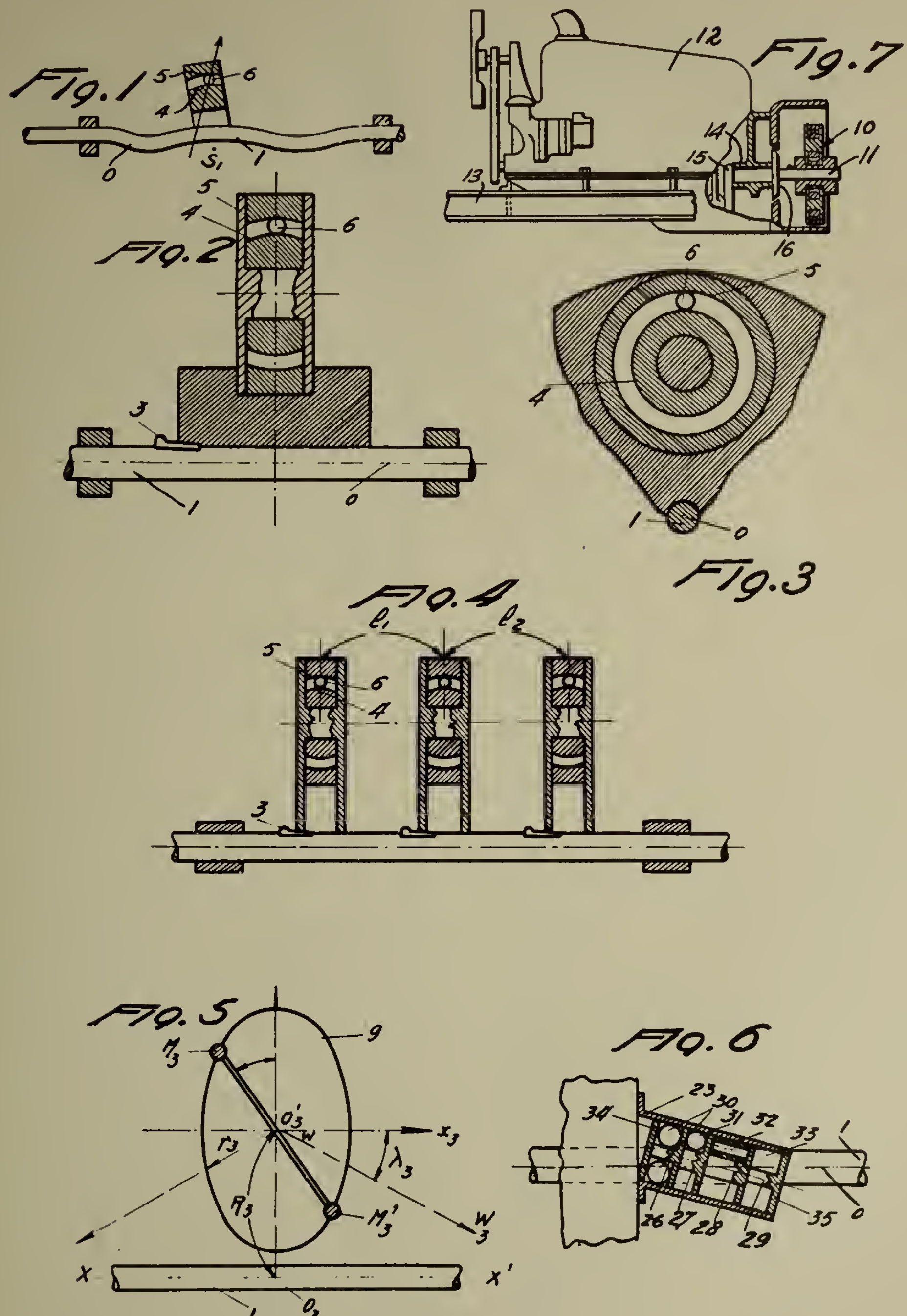

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ALIEN PROPERTY CUSTODIAN

DEVICES FOR FILLING AND EMPTYING CARTRIDGE BELTS

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Application filed March 18, 1938

This invention relates to a device for filling and emptying cartridge belts, the device being provided with a displaceable ejector for the cartridges and with a drum for feeding the belt thereto, which drum is controlled by a shaft movable by a displaceable part of the driving mechanism.

The invention has for its chief object to provide a device which will ensure a rapid filling of the belts with the cartridges without hinderances which arise especially owing to the incorrect position of the cartridges in the cartridge container.

According to the present invention the filling device is provided with a device for holding the cartridges that are located in the cartridge container of the filling device and are above the pushed out cartridges, which holding device is controlled by the cartridges which are pushed out of the charging space and into the cartridge belt by means of the ejector. Owing to the fact that the mechanism for holding the cartridges in the cartridge container is controlled directly by the pushed out cartridges, the correct operation is ensured especially when, according to a further feature of the invention, a shaking device is used, the movements of which in one direction are controlled by means of a spike that is connected with a displaceably movable slide on which there is arranged the ejector that affects the pushing of the cartridges out of the charging space into the cartridge belt.

The filling device according to the invention can be used both for filling and for emptying the cartridge belt; this is effected by altering the path of the cartridge ejector. This alteration of the path is obtained by means of a simple device which is based on the fact that the slide, on which the cartridge ejector is arranged, is provided with two grooves with which the pin of the crank-drive mechanism engages as required.

In view of the fact that the holding member is controlled by the pushed out cartridges, the filling device according to the invention is of simpler construciton than previous devices of this kind, cheap to produce, readily operated, light in weight and suitable for transport.

In order that the said invention may be clearly understood and readily carried into effect, the same will now be described more fully, by way of example, with reference to the accompanying drawings in which:—

Figure 1 is a longitudinal sectional view of a filling device embodying the invention, the device being adapted for filling cartridge belts in which two cartridges are pushed into the belt at the same time, the parts of the device being shown in the position before pushing a cartridge out of the cartridge container;

Figure 2 is a longitudinal elevation, partly in section, showing the parts of the filling device in the position occupied during the pushing of the cartridge into the belt;

Figure 3 is a cross-section taken on the line III—III of Figure 1;

Figure 4 is a cross-section taken on the line IV—IV of Figure 1 but showing a modification of the device for reversing the slide; and

Figures 5 and 6 show a sectional elevation and a plan view, respectively, of the holding member for the cartridges.

Referring to the drawings, 1 denotes a box-like base body having 2 feet for fixing the same. The drive of the mechanism consists of a crank 5 (Figure 4) which is keyed on a pin 6 that is mounted in a bearing 3 in the wall of the box 1. On the side of the pin 6 that is inside the box a crank 7 is provided with a pin 8 which engages in a groove 11 or 12 (Figure 1) in a slide 10 that is displaceably arranged on a holder shaft 17 which is rotatably mounted in bearings in the side walls of the box. For this purpose, the slide 10 is provided with a tubular attachment 13 which is mounted on the hollow shaft 17 that is provided with a helical groove 16 in which a pin 15 on the attachment piece 13 on the slide engages, so that, during the displacement of the slide, the shaft is rotated. Since the crank mechanism is symmetrically arranged, the operation of the device is not altered whether the crank handle 5 is rotated in one direction or the other.

On an offset end 18 of the shaft 17 there is loosely mounted a drum 20 for feeding the cartridge belt (not shown) to the device, which drum is provided on the periphery thereof with teeth that engage in the individual members of the belt.

The said drum is provided on one end face with teeth 21 which engage with teeth formed on a tube 22 (Figures 1 and 2) which is mounted on the shaft 17 and is loaded by a spring 23. The teeth are formed in such a manner that they engage when the shaft is rotated in one direction whilst they slip over each other when the shaft is rotated in the opposite direction. In order to prevent the drum from turning back, a disc 25 (Figure 1) is mounted on the hub of the drum so as to be displaceable by means of a spring 27 acting thereon. The disc 25 is provided with

teeth 26 the engaging surfaces of which are reversely formed to the surfaces of the teeth 21 and which in one direction engage with the teeth on a disc which is rigidly connected with the bearing on the box for the mounting of the end of the shaft 17.

A cartridge container 30 is removably connected to the box 1 by means of a lever 53 (Figures 1 and 2) which is rotatably mounted on a pin 52 and a projection 54 on which engages with fixed teeth 55 on the box 1. Connected to the cartridge container 30 is an attachment 51 which prevents the cartridge belt from slipping out of the teeth of the feeding drum 20. The cartridge container 30 (Figure 3) is divided by a vertical wall 31 into two chambers from which the cartridges are passed into two charging spaces 40 and 40' which are formed as channels on the top wall of the box 1. The charging spaces are provided with longitudinal openings 41 and 41' through which flat ejectors 14 and 14' for the cartridges pass. These ejectors form a bifurcation on the tubular attachment 13 on the slide 10.

One part of the dividing wall 31 of the cartridge container forms the shaking device which ensures the continuous feeding of the cartridges into the charging spaces. The shaking device consists of two plates 34 and 35 which are bent into a ridge- like shape and the bottom parts of which are turned towards each other. The parts 34 and 35 of the shaking device are provided with hangers by means of which they are mounted on a pin 32 which is mounted in eyes formed on the bottom edge of the dividing wall 31. Arranged concentrically with the pin 32 is a spring 37 one end of which is attached to the part 34 and the other end of which is attached to the part 35 of the shaking device, the said spring maintaining the parts in the facing position, so that these parts form a hollow prism that is suspended on the pin 32 by means of one edge. On the side facing the slide, the two parts 34 and 35 are provided with bevelled stop pieces 38 and 39, respectively, between which is passed a flat wedge spike 13' of rectangular cross-section (Figures 1 and 4) which is rigidly fixed in dovetail manner to the slide 10, so that it carries out the pushing movement. The spike 13 is guided in a guide 4 which is formed in the top wall of the box 1 and which also serves as a guide for the slide 10. Suitable openings are formed in the cartridge container for the passage of the spike through the wall of the box and the cartridge container.

Beneath the cartridge container 30 there is arranged a cartridge holder which consists of a lever 46 of the first order rotatably mounted on a pin 45 that passes through the walls of the box. One arm of the cartridge holder passes into an opening 50 in the box, through which opening the cartridges are pushed out of the charging space into the cartridge belt, whilst the other arm is forked, the forked parts 47 and 47' (Figures 5 and 6) being bent to form projections 48 and 48' which, when the lever is turned, passes through the openings 41 and 41' in the charging spaces 40 and 40' (Figure 3). The lever 46 is loaded by a spring 49 which is mounted in the depression that is formed in the box beneath the wall 42 that separates the charging spaces.

The slide 10 (Figure 1) is provided with a device which permits the pin 8 of the crank mechanism to be shifted from the groove 11 to the groove 12 when the filling device is to be employed for pushing the cartridges out of the belt. One constructional form of this device is illustrated in Figure 3 and consists of a three-armed lever 62 which is rotatably mounted on a pin 61 fixed in eyes 60 formed in the slide. One arm 63 of the lever is provided with a tooth that engages with an opening 10' in the slide (Figure 2), and a second arm 64, which serves for operating the lever, is loaded by a spring 66, whilst a third arm 67 merges into a projection which engages, only in a definite position, in an opening 68 formed in the shaft 17.

Another constructional form of this device, which is illustrated in Figure 4, is similarly formed, since here also a three-armed lever is employed which is rotatably mounted on a pin 71 on the slide. One arm 72 engages, just as in the first construction, with the opening 10' that is formed in the slide, and a second arm 73 is formed as an operating lever 73 which can be pressed only when the slide is located in a definite position in relation to the box, since there is formed in the wall of the box an opening 76 which renders the pressing of the lever 73 possible. The third arm of this lever is loaded by a spring 75 which maintains a projection on the arm 72 of the lever in engagement with the opening in the slide.

Before the filling of the cartridge belt is commenced, the slide 10 is adjusted so that the pin 8 on the crank 7 engages in the straight groove 11 (Figures 1 and 3). The displacement of the slide 10 on the shaft 17 is effected by rotating the crank handle 5, during which displacement the ejectors 14 and 14' push the cartridges out of the cartridge spaces 40 and 40'. The pushed out cartridges slide on the shorter arm of the holder 46 for the cartridges and causes the rocking of this lever, so that the forked parts 47 and 47' of the arm pass, by means of their projections 48 and 48', through the openings 41 and 41' of the charging spaces and hold the bottom cartridges fast. so that the latter do not fall into the charging space and thus do not cause any possible disturbance. After the cartridges are pushed out, the slide returns with the ejector. During this movement, the teeth 21 on the tube 22, which are loaded by the spring 23, come into engagement with the engaging surfaces of the teeth arranged on the feeding drum, and the cartridge belt is displaced through two divisions and is thus prepared for further filling.

During the working movement of the ejectors (in the direction of the arrow p), the teeth 21 slip over each other and the teeth 26 on the disc, which is displaceably mounted on the hub of the feeding drum, come into operation which teeth 26 engage with the teeth on the fixed disc 28, so that they prevent the feeding drum from being rotated back and thus secure the adjusted position.

In the working movement of the ejectors (in the direction of the arrow p), the shaking device also comes into operation, since the wedge spike 13, which moves with the slide, passes through the openings in the box and the cartridge container 30 and strikes the bevelled stop pieces 38 and 39 of the parts 34 and 35 and moves them against the action of the spring 37, as can be seen from the broken line position shown in Figure 3. On the return movement, the spring 37 brings the parts 34 and 35 back into their original position as soon as the spike 13 comes out of engagement with them, and this operation, which is repeated on every working stroke, causes the shaking and the arranging together of the car-

tridges, so that the latter can be fed continually into the charging space without any hindrance which would result from the spreading apart of the cartridges.

During the return movement of the ejectors **14** and **14'**. the latter keep the arm of the cartridge container **46** in the position represented in Figure 2. It is only when the ejectors leave the shorter arm of the holder that the lever **46** is turned, under the action of the spring **49**, into the position shown in Figure 1, in which position the shorter arm engages in the opening **50**, so that it prevents the cartridges from falling out accidentally, and the second forked arm moves with its projections **48** and **48'**, out of the openings **41** and **41'**, so that it frees the way for the lowest cartridges to lie in the charging spaces and to be prepared for being pushed out.

The filling device according to the present invention is arranged in such a manner that the filled belts can also be emptied thereby. The pushing of the cartridges out of the cartridge belt, which is also mounted on the feeding drum, is effected by the path of the ejectors **14** and **14'** being prolonged by as much as is necessary for pushing the cartridges out.

For this purpose, the slide **10** is secured firmly in the position in which the projection **67** is adjusted opposite the opening **68** (in the construction shown in Figure 3) or the lever **73** is adjusted opposite the opening in the box **1** in the case of the construction shown in Figure 4. In these positions, it is possible to press the arm **64** or **73**, which pressure results in the projection on the arm **63** or **72** coming out of engagement with the opening **10'** in the slide **10**. The pin **8** of the crank is then brought over into the groove **12** in the slide, with the result that the path of the ejectors **14** and **14'** is prolonged in the direction of the arrow *p* to such an extent that the pushing of the cartridges out of the belt is rendered possible. Upon the release of the arm **64** the corresponding arm of the securing lever drops into the opening in the slide and the filling device is prepared for the pushing out. The groove **12** is curved in a part **12'** thereof, as can be seen from Figures 1 and 2. The object of the curved part **12'** is to obtain a greater force on the pushing of the cartridge out of the belt, since, as is known, the cartridge is held in the known manner by means of a groove or by means of the edge of the cartridge by a projection formed in the cartridge belt.

The groove **12** may be provided with two curved parts **12'** and **12''** in order to enable the cartridge to be pushed easily out of the belt in the rotation of the crank to one side or the other.

It will be understood that the filling device described and illustrated is given only as an example of an embodiment of the invention and that the individual details thereof may be varied without altering the scope of the invention.

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PUBLISHED

JUNE 1, 1943.

BY A. P. C.

V. HOLEK ET AL

DEVICES FOR FILLING AND EMPTYING

CARTRIDGE BELTS

Filed March 18, 1938

Serial No.

196,790

2 Sheets-Sheet 1

Fig. 1.

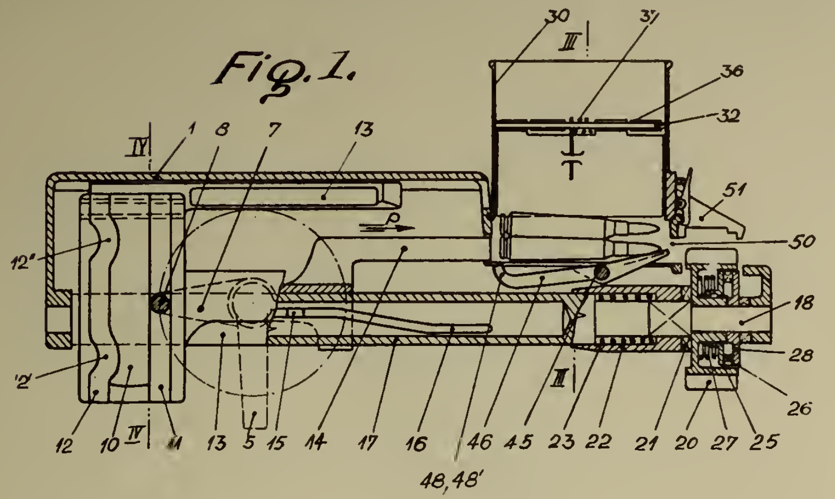

Fig. 2

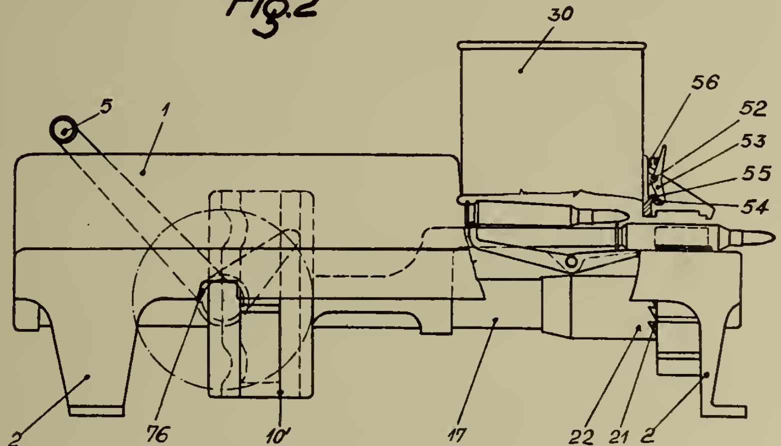

Fig. 5

Fig. 6

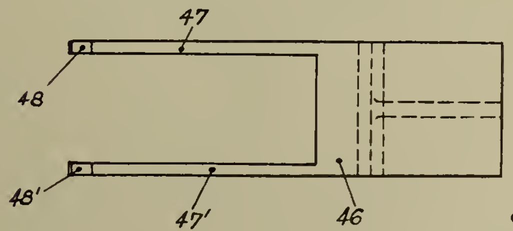

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Fig.3

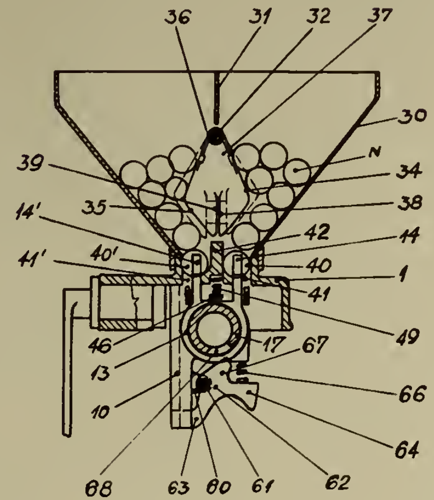
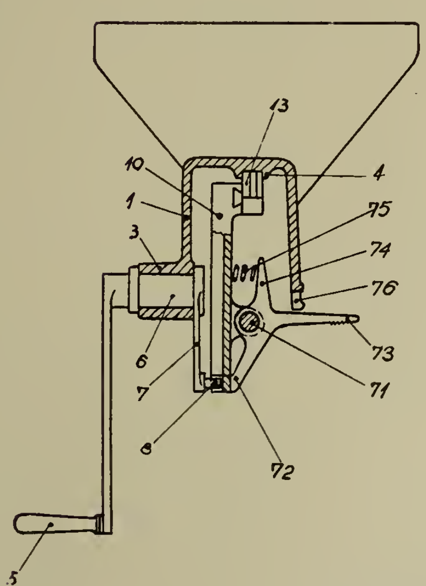


Fig.4



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Published June 1, 1943 Serial No. 207,115

ALIEN PROPERTY CUSTODIAN

MOUNTING OF ACCESSORIES ON AN AIRCRAFT

Charles Raymond Waseige, Rueil, France; vested in the Alien Property Custodian

Application filed May 10, 1938

The present invention relates to the mounting of accessories on an aircraft.

It is known that modern aircraft are provided with a number of accessory apparatus such for example as high, medium and low pressure air compressors, vacuum pumps, electric generators, hydraulic pumps, etc., the operation of which is necessary for the operation of numerous instruments.

Hitherto such accessories have generally been directly mounted on the engine, but the multiplicity and variety of said accessories makes such a mounting more and more difficult. Furthermore, engine constructors are in that case obliged to provide on their engines brackets and driving devices which are not always used, in the case of multi-engine aeroplanes, for example. This therefore leads to making rear parts of engines different, according to the use on the aeroplane, and this is very disadvantageous as regards interchangeability.

It has also been proposed to drive these generators by means of electric motors or by auxiliary engines, but these solutions are generally heavy and costly.

The present invention proposes to overcome the above mentioned drawbacks and for this purpose it provides, in distinction to the foregoing, for the fixing of all or of a part of the accessory apparatus, which are not directly necessary for the operation of the engine, on the outside of a common movement take-off box which is independent of the engine and is fixed directly on the structure of the aeroplane, the movement take-offs of said box being driven by the engine through the intermediary of a common double cardan shaft which is preferably flexible or is associated with any other device allowing of oscillations of the engine and small longitudinal movements relatively to the accessories.

The engine in this case only requires to be provided with one remote control take-off for driving said movement take-off box.

By way of an example which is in no way limitative, an embodiment of the invention has been shown diagrammatically in the accompanying drawing, which embodiment has, in addition to the above defined peculiarities, other peculiarities which will be described hereinafter and more fully pointed out in the claims.

In the drawing:

Fig. 1 is a mounting diagram of accessories on an aeroplane in a manner according to the invention;

Fig. 2 is a corresponding partial view looking in the direction of the arrow designated by *f* in Fig. 1;

Fig. 3 is a vertical section, on a larger scale, of the movement take-off box, along the axis of the drive shaft;

Fig. 4 is a similar view to Fig. 3 of the movement take-off on the engine;

Fig. 5 is a partial section along the line designated by V—V in Fig. 2;

Fig. 6 is a view of a modification of the drive shaft.

In this embodiment it has been assumed that five accessories are to be mounted, viz, an electric generator 1, a high pressure air compressor 2, a medium pressure air compressor 3, a vacuum pump 4 also serving as a low pressure compressor, a hydraulic pump 5 serving for example for supplying jacks not shown. Said five accessories are fixed on the outside of a case of a movement take-off box 6 which is directly fixed on the structure of the aeroplane in such a manner that it is independent of the engine 7 and carried by its supporting frame 8, by means of horizontal cross pieces 9 which are fixed at their ends on the edges of a window 10 provided in the fire-shield partition 11. The box 6 contains a suitable number of movement take-offs, five in this case, which are actuated by a common shaft 12 extending from a driving head 13 fixed on the engine above the movement take-off which is provided for this purpose on the back of the engine 7.

The movement take-off box 6 is itself composed of a substantially flat case having a vertical and substantially plane rear face and a front face comprising two plane vertical portions on either side of the central nose 14 serving as a housing for the main shaft 15. It is on said plane faces that the accessories are adapted to be mounted so that they cover the movement take-offs. The central nose 14 furthermore has at its upper part an inclined plane face 16 which serves as a support for the generator 1. The main shaft 15 drives the various movement take-off shafts 17 through the intermediary of suitable gears 18 and is itself driven, through the intermediary of a friction coupling 19 forming a torque limiting device, by the drive shaft 12. This latter engages endwise with the driving part of the coupling 19 through the intermediary of splines 20 having a slight play which enables the shaft 12 to take up a slight incline relatively to the shaft 19. Furthermore, the driving splines are shorter than the driven splines so that the shaft 12 can slide longitudinally. At its opposite end, the

shaft 12 penetrates into the driving head 13 which is formed by a case 24 fixed on the case 25 of the engine 7 above the movement take-off which is in this case formed by a bevel pinion 26 the shaft 27 of which is actuated by the engine 7. The case 24 supports a shaft 28 on which is fixed a pinion 29 meshing with the pinion 26 and said shaft 28 is connected to the shaft 12 by a swivel joint 31 and splines 32 similar to the splines 20. The shaft 12 is furthermore so dimensioned as to form a resilient shaft which damps the vibrations and the variations of torque of the engine.

On the movement-take-off 17 which is intended for driving the generator, is arranged a torque limiting device 34 which is adjusted in such a manner that it can only transmit the maximum torque required for normally driving the generator, this being done in order to protect the members of the movement take-off box from the effects of inertia of the rotor of the generator in the event of a suddent stoppage of the engine.

One of the two movement take-offs 17, which are arranged on the same side of the central nose 14, projects through the front face of the case of the box 6, and the other through the rear face.

The case of the box 6 furthermore contains a double gear pump 36 which is driven, through the intermediary of a gear 37, by the main shaft 15. One of the two gear couples of said pump 36 delivers through the pipe 38 and ensures the forced lubrication of the various members of the movement take-off box as well as of those of the accessories which require lubricating; the other couple ensures the emptying of the case of the box 6 and the return of the oil to a reservoir not shown.

In the modification of construction of Fig. 6, a swivel joint 39 is provided to support the end of the drive shaft 12 at the entrance of the movement take-off box 6. In this case the two male and female parts are connected to each other by driving splines 40 which allow them a slight transverse play and the driving part is mounted on the shaft 12 by means of a splined sliding mounting 41. The shaft 12 is furthermore remotely surrounded by a protecting casing 42 having a flexible or resiliently deformable part.

Of course the invention is in no way limited to the constructional details described or illustrated which have only been given by way of example. Thus there may be any number of accessories and they may be distributed in any manner over the common movement take-off box. The swivel jointed modification shown in Fig. 6 can be used for the driving head which is fixed on the engine or again simultaneously on both ends of the shaft 12. The oil pump which forms an autonomous lubricating means for the movement take-off box may also be separately fitted on the outside of the case instead of being incorporated therein.

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MOUNTING OF ACCESSORIES ON AN AIRCRAFT

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Serial No. 207,115

3 Sheets-Sheet 1

Fig. 1

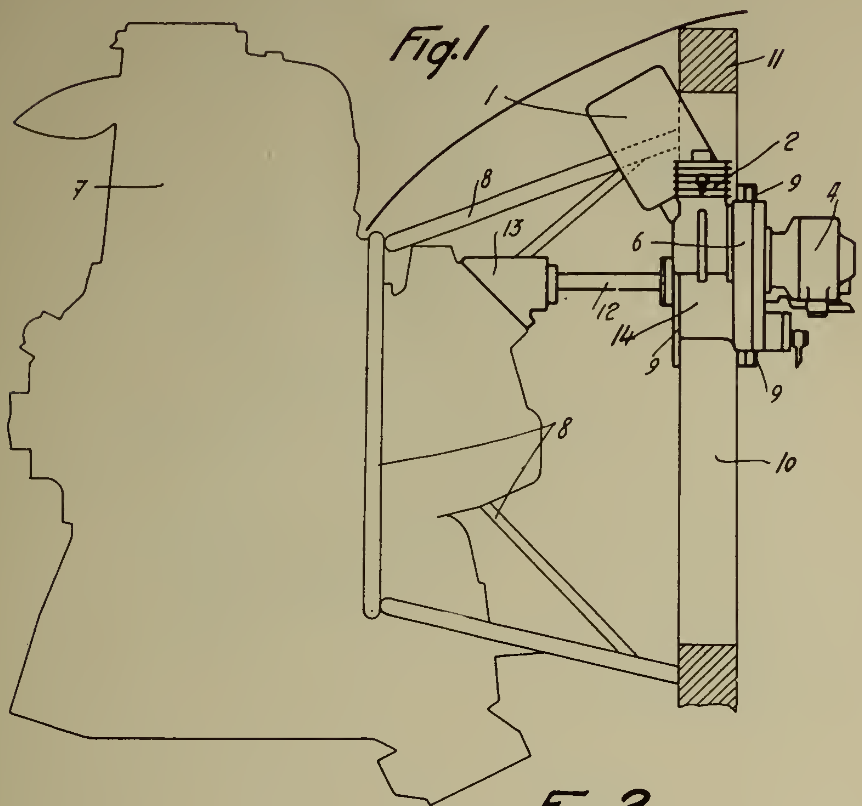

Fig. 2

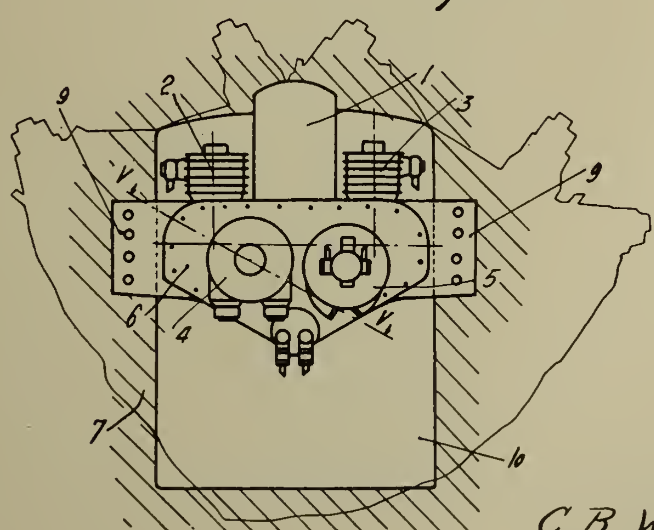

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Fig. 3

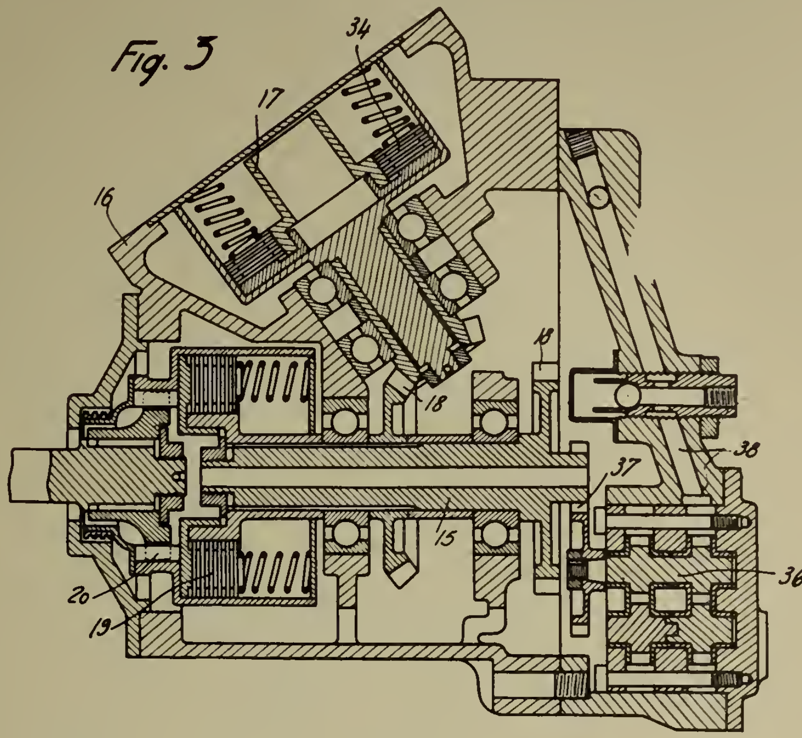
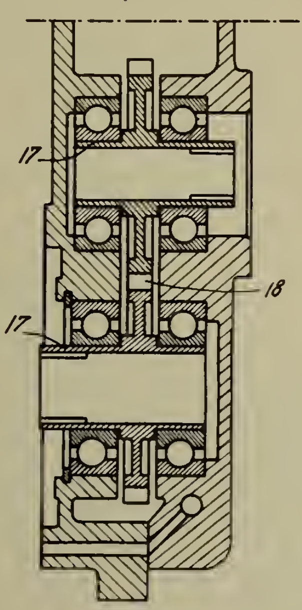


Fig. 5



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PUBLISHED	**C. R. WASEIGE**	**Serial No.**
JUNE 1, 1943.	MOUNTING OF ACCESSORIES ON AN AIRCRAFT	**207,115**
BY A. P. C.	Filed May 10, 1938	3 Sheets-Sheet 3

Fig. 4

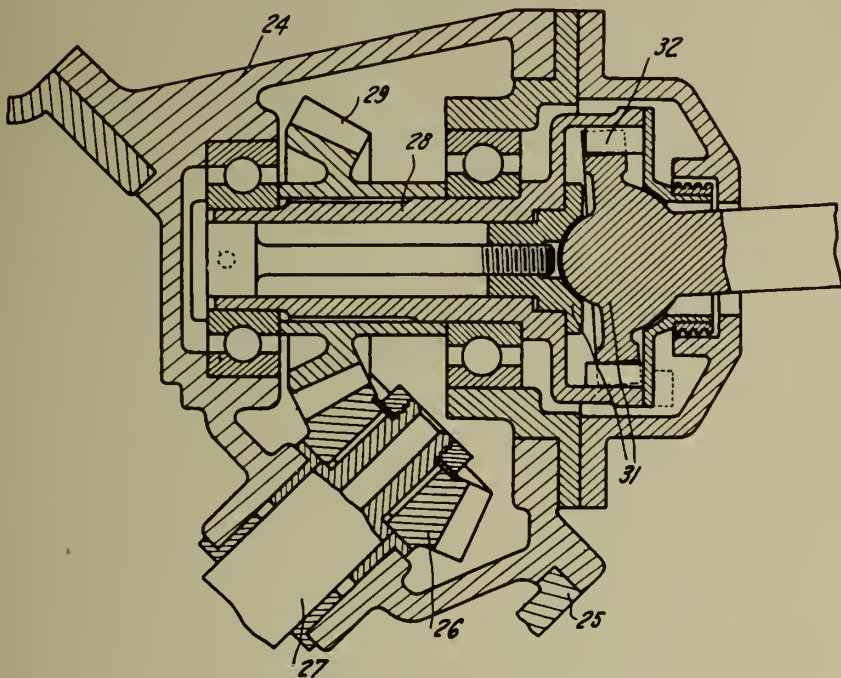
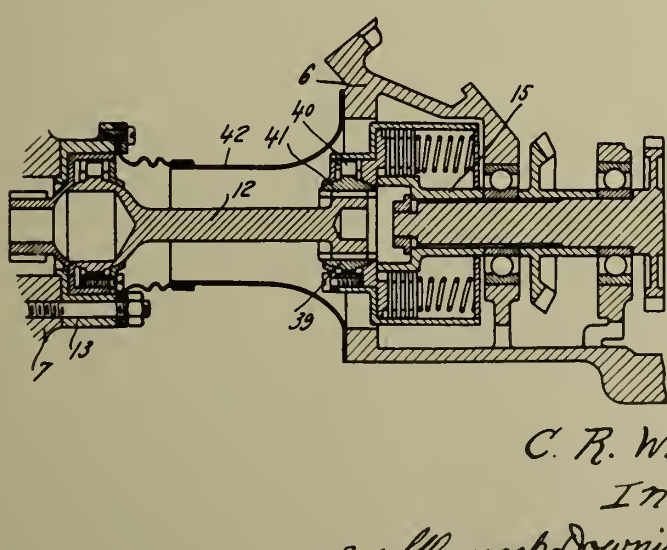


Fig. 6



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ALIEN PROPERTY CUSTODIAN

FIRE-EXTINGUISHING AND PREVENTING SYSTEM FOR MOTOR VEHICLES

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Application filed June 15, 1938

This invention relates to means for safeguarding motor vehicles, and more particularly aircraft, against the danger of fire by the use of fire extinguishing and preventing means of the spray or sprinkler type.

The invention is based on the recognition that fire extinguishing means which do not respond arbitrarily and automatically to all possible dangers whatsoever in respect of a certain type of motor vehicle and act reliably in all circumstances which might possibly arise in connection with such vehicle are not regarded in practice to constitute a safety means at all against fire, and consequently are not employed. Since now the causes of a fire and the circumstances in which the same may arise are extremely numerous and complicated in vehicles of different types, a protection against fire is not obtainable by single means, but only by a combination of different means and their adaptation to one another and to different extents of danger to form a complete fire-preventing system. To facilitate the description, but without in any way limiting the invention thereby, reference will be made in the following to the safeguarding of aircraft, in which the possibilities of a fire occurring are the most numerous, so that in other vehicles certain simplifications may be possible, particularly as regards the means for causing the system to take effect.

A fire-preventing system according to the invention comprises one or more automatic and arbitrarily acting actuating means which, when fire is liable to occur, set the sprinkler system into operation and extinguish the fire before it has time to obtain a hold or, by the cooling of hot parts of the vehicle and/or enveloping the same in fire-preventing vapours or the like, prevents the ignition of fuel oil or other inflammable substances. Automatic actuating means of this nature consist of devices which respond to the heat of a fire or parts which have become heated, to the light of a fire or to the jolts or the concussion produced when the vehicle strikes an obstacle. Photo-electric light responsive connections or also thermal connection systems making use, for example, of resilient switches having readily fusible portions or designed on the lines of bimetallic switches are known per se. Actuating means which respond to jolts or impact require in the case of a fire-preventing system designed to act in all possible circumstances certain characteristics. They must respond to jolts which may occur in any direction in any particular type of vehicle. At the same time, however, they must be so adapted that they will not respond to sudden variations in position or to sudden but harmless variations in speed, but only to jolts which are so powerful that they attain or exceed the maximum load capable of being applied to parts of the vehicle or its contents, damage to which might be liable to result in fire, so that there will be no unnecessary or possibly even dangerous actuation of the sprinkler system. Since the powers of resistance of the said parts vary in the case of jolts proceeding in different directions, so that for example the wings of an aircraft present different resistances to impact occurring from below or from the front, these shock-actuated means should preferably be so adjusted that they respond differently to jolts or impact occurring in different directions. It is also possible so to arrange in staggered relation to one another a plurality of simple shock-actuated devices each adapted to act in one or in two directions only that they supplement each other to form an actuating device responding universally to jolts occurring in all possible directions. In this case it is a particularly simple matter to furnish the separate shock-actuated devices with different degrees of sensitivity, for example by providing the inertia elements causing the actuation with different weights or by imparting different strengths to the springs or other retention means for these elements in respect of the different directions concerned. In certain cases, particularly in the case of aircraft of large size, it may be important to provide not only a central shock-actuated actuating means readily accessible to the pilot or the passengers, but also a plurality of independently acting shock-actuated devices at different points which are particularly endangered in the event of impact, so that these are struck with a force equal to that acting on the initially endangered parts, and are not merely acted upon, as in the case of the central device, by an impact which has already been attenuated by the deformation of certain external parts of the aircraft.

As additional means for causing reliable operation of the fire-preventing system in all circumstances arising the invention does not make use of a stored gas pressure for conducting the extinguishing agent to the endangered parts of the aircraft, but makes provision for generation of the gas pressure at the moment of requirement from a chemical pressure-generating reaction, preferably by the combustion of non-explosive substances. Chemical reactions of this nature,

which are initiated for example by means of an ignition device, have the advantage that they can be initiated by very small forces, which are always present even in the case of very small mass of the inertia weights in the shock-actuated means and in the case of unfavourable direction of the jolt or impact, and then supply independently of the force of the impact the gas pressure necessary for the propulsion of the extinguishing agent. Additional advantages consist in the fact that the chemicals producing the gas pressure at the time of requirement are durable, cannot escape or dissipate by reason of leakage and moreover, particularly when using substances producing the gas pressure by non-explosive combustion, are capable of being employed in solid and compact form. In addition, these substances react independently of the chemical nature of the extinguishing agent or of the outer temperature which, in the case of certain vehicles, is subject to considerable fluctuation. Further, the ignition of these substances is possible by means of cheap and simple electric ignition devices without mechanically moved initiating means.

In order that a fire-preventing system of the character described will operate reliably in all circumstances concerned in respect of a given type of vehicle the part of the system generating the gas pressure must be placed in communication with a container for the fire-extinguishing agent which permits of a discharge of the fire-extinguishing agent in all positions of the vehicle. For example, the container for the extinguishing agent, with corresponding connection of the pipes for discharge of the liquid, may be suspended in universal disposal or, in the manner known per se, furnished with movable internal members which ensure a proper discharge of the liquid, for example with a flexible pipe which is loaded with a weight at its free end, so that the discharge of the liquid always occurs from the lowest point of the container. Since, generally speaking, in the case of vehicles, on account of the necessity of extinguishing burning fuel and oil, aqueous extinguishing agents cannot be employed, and primarily organic substances are used, such as tetrachloride of carbon, trichloride of ethylene and the like, generation of the gas pressure by way of wet reactions must take place separately from the extinguishing agent. Special precautionary measures then require to be taken to ensure that the gas pressure resulting from the chemical reaction is able to act on the extinguishing agent independently of the position of the vehicle.

Care also requires to be taken that the reaction producing the gas pressure proceeds steadily without disturbance, and that undesirable by-products of the reaction, such as heat, soot, smoke or the like, are unable to exert a detrimental effect. When employing the substances which produce the gas pressure by non-explosive combustion and are particularly suitable for protecting vehicles against fire it is desirable to provide the cartridge or container in which the substances are stored, consigned and also burnt in the extinguishing liquid itself, so that during the combustion it is surrounded on all sides by a sufficient depth of the extinguishing liquid despite the decrease in the volume of the latter owing to its discharge. It is, therefore, not desirable to provide the reaction container or the cartridge for these combustible substances in a secondary container which is accommodated in the extinguishing agent and the wall of which is only a relatively slight distance away from that of the reaction container, as in this case the space between the two containers acts in insulating fashion and impairs the assimilation of the heat of reaction by the extinguishing liquid. If on the other hand the extinguishing liquid surrounds the cartridge to a sufficient depth and the gases are compelled to pass through the same, the gases are also cooled, and the soot and smoke components or other residual products of combustion contained therein are washed out. They then remain distributed in extremely fine suspension in the extinguishing liquid and do not contaminate the same.

Additional details of construction of the new fire-extinguishing and preventing system which appreciably assist to render the system perfectly reliable under all conceivable conditions and to simplify to the utmost its arrangement and operation will be described in conjunction with the different embodiments shown in the drawing. In the latter

Fig. 1 indicates diagrammatically the outlay of a fire-preventing system for a large vehicle having numerous actuating devices.

Fig. 2 is a section taken through a cartridge containing a combustible substance for supplying gas pressure, the said cartridge being mounted in a container for the extinguishing agent.

Fig. 3 is a section through a heat-consuming reaction container.

Fig. 4 shows a secondary container for wet pressure-generating reactions with steady and uninterrupted discharge of the gas pressure.

Fig. 5 is a perspective view of a shock-actuated actuating device having different degrees of sensitivity in different directions.

Figs. 6 and 7 illustrate possible embodiments of the manner in which the sensitivity of the actuating device can be readily varied during the movement of the vehicle, and

Fig. 8 shows a shock-actuated actuating means which is effective in all directions and initiates the chemical reaction in direct fashion without auxiliary electrical means.

In Fig. 1, 1 is the container for the extinguishing agent having inserted therein the cartridge 2 containing the substance which generates the gas pressure by combustion. 3 is the conventional internal arrangement by means of which the extinguishing agent is discharged from the container independently of the position of the vehicle. 4 is the pipe which conducts the extinguishing agent to the single points of discharge 5 situated in the vicinity of the endangered parts. 6 is a current source provided on the vehicle, and 7 is a central shock-actuated actuating device (for example as illustrated in Figs. 5 to 8), which is effective in all possible directions and the sensitivity of which can readily be varied by the occupants of the vehicle when the latter is in motion. Shock-actuated actuating devices 8 are provided at particularly endangered points of the vehicle, so that in the case of collision with any obstacle they receive practically the same impact as the said parts, and not merely an attenuated impact such as that imparted to the central device 7. There are provided two thermal contacts 9 of the conventional kind, whilst 10 is a photo-electric switch of the kind known per se which responds to the light of a fire. 11 is an arbitrary actuating device for the whole system. The leads 12 are in

part common to all of the actuating devices and are acted upon by suitable means, such as an electrical ignition device, for the purpose of initiating the reaction generating the gas pressure. 13 is a switch fitted in the pipe 4, for example a small cylinder having a piston and a spring, which is moved by the extinguishing agent under pressure and exerts an auxiliary effect, for example closes the fuel pipe or disconnects the current in the vehicle.

If one of the devices 7 to 11 completes the circuit of the current source 6, the ignition device of the cartridge 2 is set into operation and in turn ignites the combustible substance in the cartridge. The gas pressure thus generated forces the extinguishing liquid from the container 1 through the pipe 4 to the endangered points.

Fig. 2 shows on larger scale the cartridge 2, which projects into the extinguishing agent and is thus cooled.

14 is a socket adapted to receive the cartridge 2, which contains the substance 2 compressed into compact form and generating the gas pressure by non-explosive combustion. This substance is acted upon by the two independent electrical ignition devices 17*a* and 17*b* which, proceeding from the rear end of the cartridge, terminate in the insulated contacts 18*a* and 18*b*. 19 is the screw-on cover, which is adapted to be applied in gastight fashion, for example by means of the packing 20, and in which the contacts 21*a* and 21*b* are so mounted in insulated fashion that by the application of the cover the ignition device is connected up with the circuit. 15 is a small air pocket in the cartridge 2 formed by the distance piece 22, whilst 23 is a moisture-proof cover having the gas outlet aperture 25, which is closed, for example, by a destructible foil 24 soldered thereto. This outlet aperture may also be provided in the form of a plurality of smaller apertures. The strength of the seal is preferably such that it does not open until the pressure in the reaction chamber has reached such a degree that it is capable of overcoming not only the hydrostatic pressure but also the pressure of the mass arising from any movement of the system (pressing pressure from acceleration or retardation). 26 is a screen through which the gas is compelled to pass for the purpose of better distribution in the liquid. 27 is a plug which is composed of clay or the like and is furnished with a passage and which ensures that the part of the cartridge in which the combustion takes place extends to a sufficient degree into the extinguishing liquid independently of the position of the vehicle and the progressive discharge.

28 (Fig. 1) is the usual air pocket in the container 1. 29 is the filling device for the extinguishing agent, which device is so arranged that when pouring in the extinguishing agent the air pocket is maintained automatically.

In Fig. 3 there is shown another embodiment of the cartridge in which the combustion reaction producing the gas pressure does not take place within the extinguishing liquid. Other means are accordingly employed for making the heat of the combustion gases and the radiation of the hot cartridge harmless. 30 is the pressure-resisting wall of the reaction container, in which the cartridge 2 with the electrical ignition means 17*a* and 17*b* and the cover 19 is mounted in a manner similar to the embodiment in Fig. 2. In the cartridge the substance 16 producing the gas pressure upon combustion is surrounded by a jacket composed of heat-consuming material, for example by a pressed hollow cylinder 31 consisting of sodium bicarbonate with or without the addition of a catalyst, which is decomposed by the hot residue of the reaction by the separation of additional carbonic acid with the consumption of heat. About the container 30 there is disposed a second wall 32 consisting, for example, of thin sheet metal. The intermediate space between the two walls, whilst leaving room for expansion, is filled out with a heat-consuming, for example fusible substance, such as wax, fusible salts or the like. 33 is the pipe for conducting the generated pressure gas to the container for the extinguishing agent. The outlet aperture is closed by a movable filter device, which consists, for example, of the fixed screen plates 34*a* and 34*b*, a loosely disposed intermediate layer of asbestos 34*c*, and a ring 34*d*. After removal of the cover the two screen plates and the intermediate layer can be readily withdrawn by the ring with the aid of a hook for cleaning purposes. At the same time they scrape from the walls of the container 30 any traces of soot, smoke or ash or any other undesirable components.

In Fig. 4 there is shown a pressure-resisting container 30 for carrying out wet gas-pressure producing reactions, for example the generation of carbonic acid from carbonate and an acid. 35 is a mixture of dry pulverulent sodium carbonate and powdered oxalic acid compressed in equal amounts into the form of tablets or the like. 36 is a small auxiliary container, which is separated by a screen and in which there is located, for example, a small glass vessel 37, in which there has been fused a certain amount of water. There is also included therein an electric ignition device 38 with a small auxiliary charge of powder or flashlight substance. If the ignition device is operated by one of the actuating devices, the small glass vessel is destroyed, and the water passes into the container 30, where it enters into contact at the lowest point thereof, independently of the position of the vehicle, with the mixture of acid and carbonate and causes the conversion thereof by its moistening action. The pressure gas formed is conducted through the pipe 33 to the container for the extinguishing agent. The pipe 33 is so arranged or so disposed in the container 30, for example towards the centre thereof, and the container only filled to such extent that merely gaseous products are discharged, whilst material not yet converted or other residual substance is unable to obtain access.

Fig. 5 shows a possible embodiment of a shock-actuated actuating device, which comprises a plurality of small and simple single actuating devices supplementing one another to form a shock-actuated means which is effective in all directions. Owing to its cheapness, simplicity and ready adjustability an embodiment of the nature is to be preferred to a shock-actuated device in which an inertia element is shiftable in all directions. Six tubes 39 composed of insulating material are preferably united to form a block or common container. In each of these there is located, in accordance with Fig. 6 or 7, a spring 45 and an outwardly shiftable inertia weight 42 composed of metal, in which connection the sensitivity of actuation may be made to vary in different directions by making the springs of different strength or the inertia weights of different size. In the path of the resiliently held inertia members, as shown in Fig. 6, there are provided in different spacial disposal two pairs of

contacts 40, 41. The pair of contacts 40 situated nearer to the weight 42 are normally not connected up with the circuit. If an impact is so powerful that the inertia weight reaches the outer pair of contacts 41, the circuit is completed and the chemical reaction caused to be initiated. If for certain reasons, for example in the event of a forced landing, it is desired to make the shock-actuated device more readily responsive, the circuit is switched over to the inner pair of contacts 40. A slight movement of the inertia weight is then sufficient to complete the circuit and cause the system to take effect.

In the embodiment of the actuating device according to Fig. 7 the inertia weight 42 possesses a boring 43 extending through the casing or an upwardly projecting eye. Through the boring or eye and the casing there is passed in splint-like fashion a wire or needle 44 consisting of brittle steel, which holds the weight in position. In the event of a sufficiently powerful jolt or impact the needle is broken, and the weight moves in opposition to the weak spring 45 against the contacts 41. If the wire is cut or the splint-like needle 44 withdrawn when the vehicle is in motion, the inertia weights are merely held by the weak springs 45, and a comparatively slight jolt or shock is sufficient to cause the actuation. It is also possible to secure to the one end of the weights wires in loop-like form having a specific breaking strength, and to pass a splint-like pin through all loops, so that the weights are all readily operable when the pin is withdrawn and it is no longer necessary for the wires first to break for the purpose of the actuation.

Shock-actuated devices may also be designed in which the reaction resulting in the generation of the pressure gas is initiated in response to jolts or impact in any direction by means of one single actuating device. Further, the chemical reaction may be initiated in direct fashion, i. e., without the interposition of electrical means.

In Fig. 8 there is shown, for example, a casing 46 having conical end faces, in which there are located the two inertia members 42 also having conical end faces. They are separated by the spring 45 and bear one opposite to the other the percussion cap 48 and the pin 49. The two inertia members are also separated by the wire 44, which is broken in the event of jolts or impact of a certain force. If the wire is withdrawn, the two weights are held apart merely by the spring 45. If the weights are thrown together as the result of impact, the percussion cap 48, and if desired also a small auxiliary charge, is caused to be ignited. The pressure of the gas presses the small piston 51 in the abutment 50 outwards, and after breaking the destructible foil 52 sprays the water 53 against the substance 35 producing the carbonic acid in the auxiliary container 30, and thus initiates the conversion.

WILHELM KOCHMANN.

PUBLISHED

JUNE 1, 1943.

BY A. P. C.

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2 Sheets-Sheet 1

Fig.1

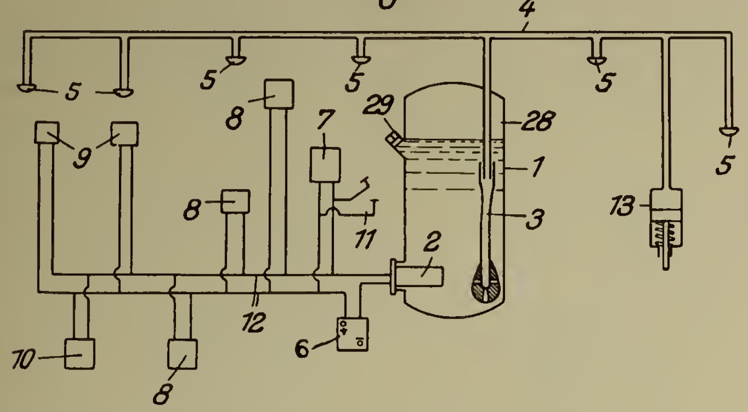


Fig.2

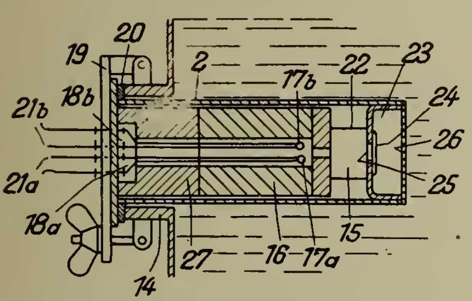


Fig.3

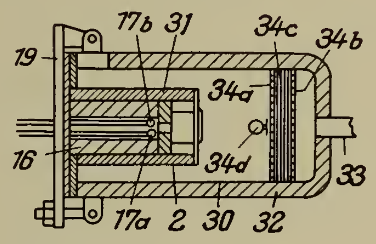


Fig. 4

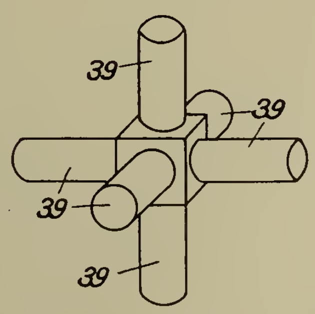


Fig.5

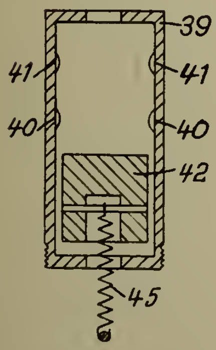
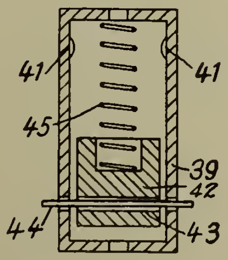


Fig.6



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213,902

2 Sheets-Sheet 2

Fig. 5 Fig. 6

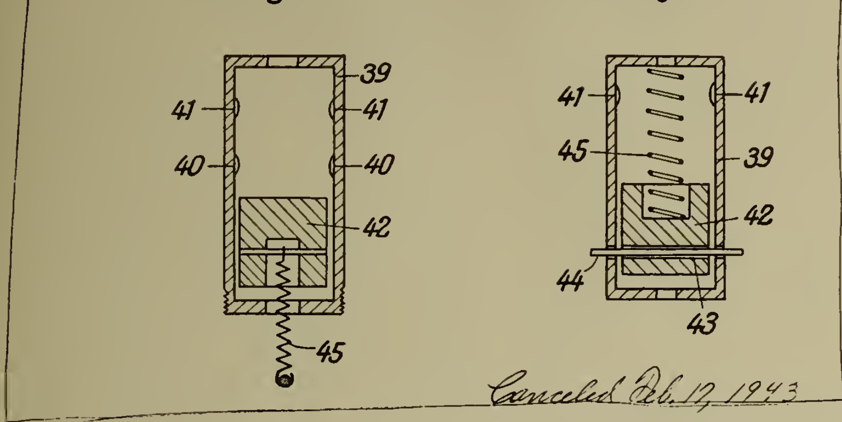
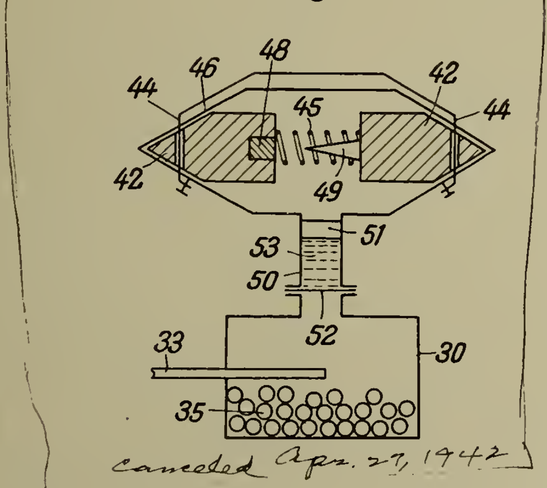


Fig. 8



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ALIEN PROPERTY CUSTODIAN

HIGH FREQUENCY ELECTRIC FURNACE FOR THE PRODUCTION OF OXIDES OF NITROGEN

Gaston Lefort des Ylouses, Paris, France; vested in the Alien Property Custodian

Application filed June 11, 1938

This invention relates to a high frequency electric furnace for the production of oxides of nitrogen.

In electric arc furnaces intended for the production of oxides of nitrogen, the simultaneous use of high frequency currents and reduced pressure give much increased outputs, but a sufficiently low pressure is expensive to produce, and can hardly be considered unless a means can be found of recovering the necessary energy.

Experience shows that high blowing speeds do not harm the production of oxides of nitrogen, any more than the stability of the arc, when high frequency current is used. This fact renders possible the use of a diverging compression tuyere after the arc, and consequently a considerable raising of the pressure to the suction of the air pump, which means considerable economy.

In order to obtain the greatest possible recovery of pressure, it is important to produce the reduced pressure by passage into an expansion tuyere, allowing the speeds to attain very high values—higher, in principle, than the speed of sound and, for example, ranging between 400 and 700 metres per second. The pressure is thus low, for example of the order of 100 grams residual pressure, while the temperature is very low, for example from —100° to —150° C.

This air of high velocity, low pressure and very low temperature, arrives on the electric arc. The high speed leads to a small section. The distance between the electrodes and the axis of the furnace is thus necessarily small.

In order to avoid the effect of shock, the loss of speed and the abrupt rise of pressure which would be produced by a short arc, the arc is lengthened, so that the supply of heat may be progressive.

The lengthened arc also has the advantage of taking a lower intensity, for an equal power. As the wear on the electrodes and the energy lost by their cooling are, above all, a function of the intensity, the lessening of the latter is very advantageous.

A short arc would lead to a high intensity, particularly as the ohmic resistance of air is greatly diminished by reduced pressure.

In the present invention, this lengthening of the arc may advantageously be effected by the use of two staggered electrodes. The first of these electrodes may be disposed in the axis of the current of gas. Said current of gas is then annular ahead of the arc, and fills the reaction chamber from the tip of the electrode. This arrangement has the advantage of better protecting the walls of the furnace against the heat of the arc, and also of facilitating the establishing of a correct profile for the furnace.

The pressure must, above all, be very low along and at the end of the arc, in order to lessen the decomposition of NO into N+O, which is very greatly diminished by the lowering of the pressure. It is thus important to prevent the pressure from rising on passage of the air into the arc. Now, the air expands on being heated in the arc, so that it is essential to see that this expansion does not result in an increase of pressure.

When the speed of the gas exceeds that of sound, a cylindrical reaction chamber provides a reduction of the speed, and an increase of pressure at the rear. An appropriate divergence enables this increase of pressure to be avoided, and even enables a reduction of the pressure along the arc to be obtained.

The profile is so designed that the pressure remains constant, or falls a little, between the first and second electrode, from 100 to 80 grams residual pressure, for example.

The particles of air heated by the arc to the temperature of the latter are immediately cooled by mixture with the very cold air arriving.

Finally, at the outlet of the zone where the arc develops, the temperature of the gaseous mixture is lowered by 100° to 160° by comparison with what it would be if the arc were developed in quiescent air and, in consequence, at ordinary temperature. This is highly conducive to a good yield of oxides of nitrogen.

The air leaving the arc at a speed of the order of 400 to 900 metres per second, and at a temperature of several hundred degrees centrigrade, passes into a compression tuyere. The latter is preferably slightly converging at first and then diverging, the angle at the vertex of the cone being, at the maximum, from 7 to 8°.

It is thus possible to raise the pressure beyond half an atmosphere, which renders the construction of the vacuum pump very simple, while the power consumed is relatively low.

It is advantageous to cool the compression tuyere from the outside, which lessens the decomposition and, at the same time, increases the specific gravity of the gas. This increase of specific gravity permits better recovery of pressure.

The high or very high frequency arc—for example a frequency of 10^7 to 10^8 cycles per second —resists perfectly wind of supersonic velocity and, despite what might be believed, the reactance N+O=NO has time to be effected, par-

ticularly if a substantially cylindrical chamber be disposed between the furnace and the compression tuyere, where the pressure remains constant, although appreciable, for a short while. The decomposition is very low and the yield of NO is very high, being of the order of from ten to fifteen times what is obtained at low frequency and ordinary pressure, per kilowatt hour.

The high frequency currents give rise to losses through capacity in the neighbouring metallic members, thus causing not only a loss of power, but also troubles in operation, so that it is advantageous is reduce such members to a minimum.

To this end, the furnace constructed in accordance with the present invention is essentially composed of a tubular portion of tight and solid refractory material, which does not heat up to any substantial extent in a high frequency electric field.

Quartz or fused silica give excellent results and enable all external members to be dispensed with, together with all joints in the reaction chamber. Resistance to wear through dust is considerable and enables the internal surface to be kept polished, which is very important in order not to cause losses of charges.

At the same time, the expansion is almost nil and causes no cracks.

On account of the high yields obtained, the energy expended per kilo of gas is low, and an important part of this energy is absorbed by the reaction $N+O=NO$, which is endothermic. It follows that the temperature, at the outlet of the arc, is relatively low, from 100° to 400° C., for example. Under these circumstances, the quartz resists perfectly, the metallic electrode dusts do not attack it, and no fusible silicate is formed, as would be formed at higher temperatures, of the order of 1000° C., habitually used in electric arc furnaces.

After the recuperating tuyere the gases, under a pressure raised to several hundred grams, traverse a cooler and arrive in a cooled state at a vacuum pump which delivers them, either at atmospheric pressure or at a higher pressure, into absorption towers where the nitric acid derived from the oxides of nitrogen contained in the gases is collected.

In order more clearly to understand the invention, reference is made to the accompanying drawings, which illustrate diagrammatically and by way of example, a preferred embodiment thereof, and in which:

Fig. 1 is a side elevation, partly in section, of the apparatus; and

Fig. 2 is a detail of a modification.

The air arrives in the quartz furnace at **1** and leaves the same at **2** (Fig. 1).

The high frequency electric current arrives at the electrodes **3** and **4** at **5** and **6** respectively.

The gases pass into a cylindrical space **7**, and then into the compression tuyere **8**. They pass into the cooler **9**, and are taken by the vacuum pump **10**, being discharged at **11**.

The metallic electrodes are of the water cooled type.

Fig. 2 represents a modification in which the first electrode is axial.

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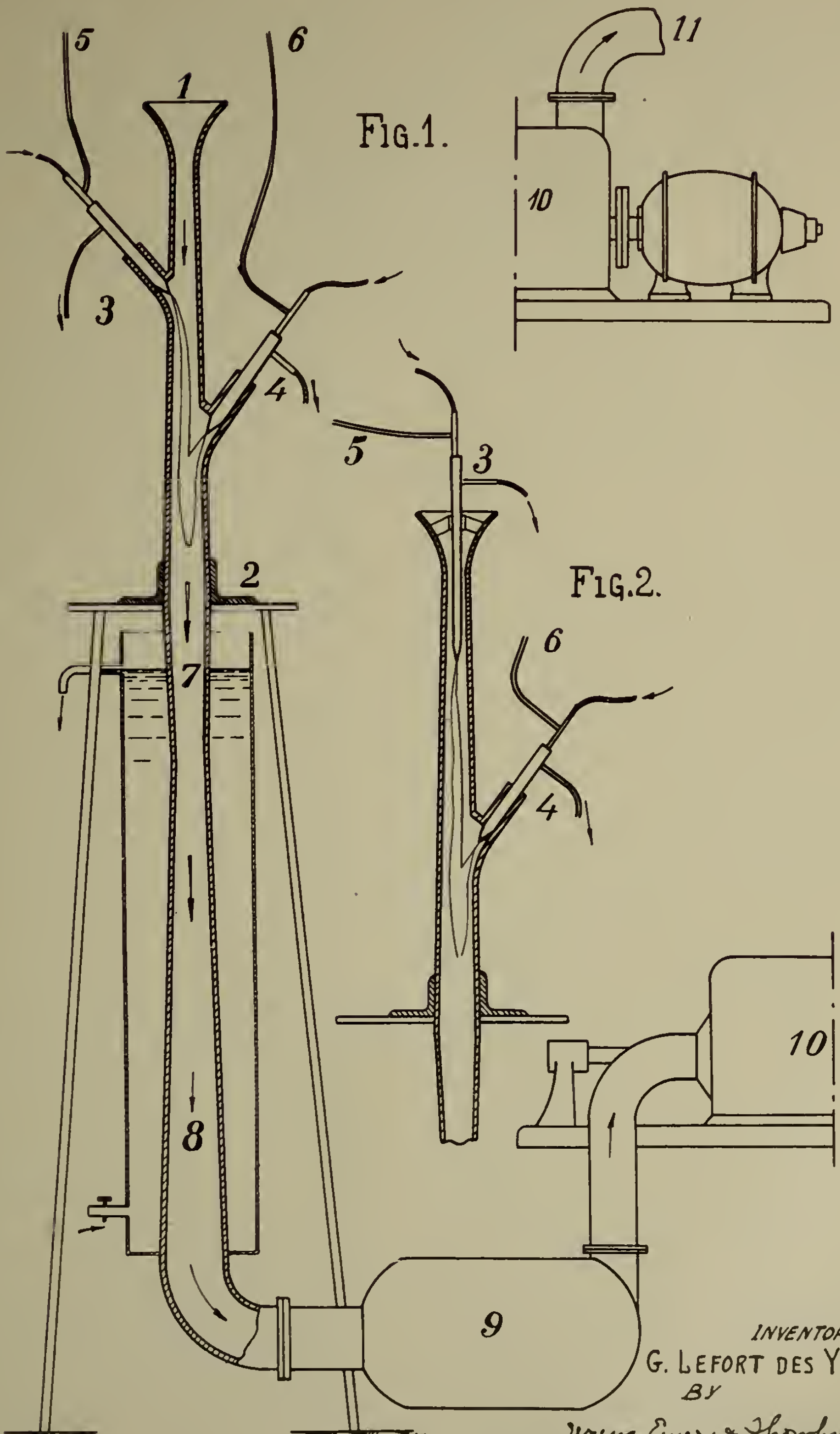

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE MANUFACTURE OF SULPHUR TRIOXIDE

Joseph Cathala, Toulouse, France; vested in the Alien Property Custodian

No Drawing. Application filed June 16, 1938

The oxidation of sulphur dioxide with the object of the preparation of sulphur trioxide is effected industrially in processes called "contact processes" by causing to pass over a very active catalyst a very dilute gaseous mixture containing by volume 7 to 10% of sulphur dioxide and 10 to 15% of oxygen, the remainder of the volume of gas being made up of inert gases such as nitrogen.

The temperature of catalysis must be maintained within rather narrow limits at about 500°C., for above this temperature (which corresponds to the maximum formation of SO_3) dissociation lowers the degree of conversion.

By reason of the low partial pressure of SO_3 obtained in the transformed mixture, the absorption of the sulphur trioxide formed is difficult.

By reason of the large quantity of dilute gases which it is necessary to employ and which can only be treated in a single passage, it is necessary to utilise very large manufacturing and absorption apparatus; the expenditure of energy necessary for the circulation of this large quantity of gas is considerable, and the quantity of catalyst in use is large (3.5 cu. m. to 5 cu. m. of catalyst to produce 1 metric ton of SO_3 per hour).

Up to now technical literature and industrial practice were in agreement in considering that, in the manufacture of sulphur trioxide by contact, it was not possible to exceed with very active catalysts this proportion of 7 to 10% of sulphur dioxide. It was even stated that if sulphur dioxide of 14 to 16% strength were available from a sulphur burner for example, it would be necessary before employing the said gas to dilute it so as to bring its content below 10%.

Now following experiments by Mr. Cathala, it has been observed quite remarkably and unexpectedly that while maintaining very active catalysts it is possible to employ gaseous mixtures the concentration of which in SO_2 and O_2 is equal to the theoretical concentration or at least equal to 50%.

As catalysts may be employed for example catalysts of platinum or of vanadium oxide fixed upon suitable support.

This catalysis, effected with concentrated gases, allows in particular to be treated by catalysis gases arising from the thermal reduction of calcium sulphate such as those obtained by the processes described in the French patent applications of the 24th February, 1937 and the 23rd April 1937, for "Process for the manufacture of sulphur dioxide" and for "Process for the reduction of calcium sulphate." It may likewise be applied to the sulphur dioxide arising from the combustion of sulphur in pure oxygen or in air to which oxygen has been added. It may also be applied to the treatment of the sulphur dioxide extracted by any physical or chemical means from the gases obtained in the industrial roasting of sulphides.

The high concentration in SO_3 of the gases after passing over the very active catalyst allows the SO_3 to be readily separated by any known physical or chemical means. A very large part if not practically the whole of the SO_3 may even be condensed directly by simple cooling and this SO_3 be collected in the liquid state. Likewise the SO_3 may be condensed by injection of water vapour or of water after the passage over the catalyst, while separating if necessary by electric precipitation the acid or the oleum produced. Water vapour may also be injected before passage over the catalyst, experiment having shown that high contents of water vapour in the gases subjected to catalysts do not reduce the yield of the conversion; the condensation of the SO_3 is thus facilitated.

The process according to the invention allows the temperatures to be varied within wide limits, between 500° C. and 750° C. approximately.

Only a small quantity of catalysts is required in use (0.125–0.160 cu. m. to produce one metric ton of SO_3 per hour). Thus a very much increased hourly production is obtained (30 to 40 times greater) with the same volume of catalysts.

In order to increase the efficiency of working of the catalyst and possibly to decrease superheating, catalysis of concentrated gases may be effected in conditions such that the oxidation of the sulphur dioxide by passage over the catalyst is systematically limited to a relatively low degree of conversion. One may then operate in closed circuit by causing the gas to pass several times over the catalyst and by separating or condensing the SO_3 produced by each passage. One may also employ several catalysts in series with separation of SO_3 between each.

The invention is illustrated in the following nonlimiting examples. All these examples correspond to experiments made with the same catalytic mass with a basis of vanadium prepared according to the usual methods. The volume occupied by the catalyst was 35 ccs. and the mass of the catalyst 14 grams.

Example 1

A gaseous mixture containing 30% of SO_2 and

Figure 5 a section through the apparatus which essentially serves for the separation of the lighter constituents.

In height the outer container 1 is subdivided into two zones A and B of which the zone A is formed by the part opening out conically downwards, and the zone B by the cylindrical part and the part connecting on downward and becoming smaller conically downward. The separation of the heavy constituents takes place in the part A and the separation of the lighter constituents in the part B. The supply of material takes place through the inlet 2 which, in order to attain as high a velocity of the material as possible is made in nozzle form and has the cross-section of a rectangle, the long side of which is parallel to the axis of the container, and the shorter side of which is as short as possible, i. e., in this case just so that the impurities pass through. In practice the dimension may be about 15 mm. In order to obviate trouble with the column of material rotating in the container, the inlet is so made that the inflowing material rests on the outside of the rotating column of material and only in the course of a revolution of about 360° gradually merges completely into the rotating column of material. Inside the container 1 is concentrically arranged the container 3 first opening out from below upwards in conical form and then running cylindrically.

The heavy constituents of the column of material are, in consequence of centrifugal action, thrown on to the wall of the container 1 and sink corresponding to the direction of flow, the conical shape of the part A and gravity to below the opening of the part 3, i. e., to below the zone C—C, whilst the material freed from these constituents rises into the container part 3. The greater the centrifugal force, the more parts are separated. In consequence of the conical shape of the container zone A, an increasing centrifugal force can develop from the cross-section 2—2 to the zone C—C. The material and water in the zone A thus represents a column which rotates in all parts with like angular velocity and the circumferential speed of which is consequently greater in the zone C—C than in section 2—2.

The parts A and B of the container 1 are separated by the screen 4 which leaves free an annular gap 5. The annular gap 5 must be as narrow as possible, in order to have for effect that the liquid in the zone B of the container 1 shall be carried away to the smallest possible extent by the rotating liquid in the part A. The lower limit of its width is, however, fixed by the nature of the heavy constituents which have to pass through. Consequently, the screen wall forming one side of the gap is kept as high as possible. The screen 4 is supported by a centrally arranged tube 6 which is carried upwardly out of the container and is continued in a pipe 7. The heavy constituents pass through the annular gap 5 into the zone B of the container 1, where only a slow rotation of the column of material takes place and the centrifugal force is practically equal to zero and where these constituents if they are capable of suspension are drawn into the pipe 6 and are carried away through the pipe 7 which has a valve or the like for regulating the suction effect.

By the suction in the annular space 5, a feeble current is produced which is sufficient to draw into the zone B the heavier parts held by the centrifugal force below the zone C—C on the container wall and there slowly sinking in consequence of gravity, so that they do not collect in the zone C—C and do not pass into the container 3. The opening of the pipe 6 in the screen 4 is screened at the bottom by a plate 8 and, furthermore, the pipes 6 and 7 are here of comparatively small cross-section, so that the suction effect of the pipe 7 only extends to the circumference of the screen 4 and no eddies are produced in the part B of the container in which the portions which are not capable of floating, sink down. The heavy constituents can be removed through a sluice valve, which consists of a container 9 which is attached to the part B of the container 1 by means of a slide 10 and which is closed at the bottom by a further slide 11. In the lower part of the sluice valve there opens a water supply pipe 13 adapted to be closed by a valve 12, and in the upper part an air pipe 15 adapted to be shut off by means of a valve 14. These two pipes have for their object to permit the sluice valve to be always completely filled with water before the opening of the slide 10, so that no injurious air enters on the opening of the sluice valve, into the container 1. There furthermore opens into the container 1 a delivery pipe 17 for dilution water, this pipe being closed by a valve 16.

The separation of the material from the lighter constituents takes place in the container part 3, these collecting round the pipe 6 whilst the material collects more towards the wall of the container part 3 in which it rises following the flow. The lighter constituents pass into a pipe 18 broadening out at the bottom into a small screen or hood 19 arranged in the upper part of the container 3, and which is arranged concentrically to the tube 6, and are exhausted through the pipe 20 which is provided with a regulating valve, by which they are carried to a supplementary cleaner or stuff save-all. The cleaned material passes, carried outwardly by centrifugal force, round the screen 19 out through the annular space 21 and is exhausted through the pipe 22 to the paper making machine. A valve or slide is provided in the pipe 22 for regulating the discharge.

Directly above the inlet 2 there is provided an annular space 23 which communicates through an outlet 24 with a discharge pipe having for its object to remove any air which may enter, out of the apparatus. Material leaving through the outlet 24 is again returned to circulation in the apparatus.

The operation of the device is all the more favourable the smaller the diameter of the annular space 21 as compared with the diameter of the container 1 directly below the inlet. These two diameters determine the velocity and thus also the inherent energy in the liquid in the inlet zone or respectively in the outlet zone. Consequently, the force at disposal in the container is dependent upon the difference of these two diameters. If the force is greater than the frictional resistances, the excess of the liquid rotating in the container zone A imparts an angular velocity which is the same in the zone C—C as in vicinity of the inflow, but a circumferential velocity which is greater in the zone C—C. The centrifugal force is most effective in the zone C—C. The cross-section of the annular space 21 is thus kept as small as the construction and output of the apparatus permit. On the other hand, the diameter of the container below the inflow cannot be kept very large for the purpose of increasing the differences in diameters,

since the size or amount of the centrifugal force is inversely proportional to the radius.

The apparatus thus operates under the following conditions:

In the zone A, where the centrifugal force is a maximum, the separation of the heaviest parts is at its best. In the zone B, where a circular movement takes place which corresponds to a centrifugal force of practically zero, and which is favourable for the separation based on gravity, there is a certain proportion of impurities which have been thrown out by a centrifugal force and drawn into the zone B and which have no sufficient density to effect their precipitation. These impurities are carried away through the pipes **6**, **7** and finally pass on to the paper making machine if they are not separated by a dilution taking place. The outflow from the pipes **6** and **7** is delivered in a diluted condition to the manufacturing return water. This is treated in one or more similar apparatuses. These after purifiers work with very great dilution; consequently the separation of the heavy constituents in the zone B is better therein and the exhaust flow from the pipe **7** of such an auxiliary purifier, which is carried into the material circulation and finally reaches the paper machine, contains considerably fewer constituents which cannot be precipitated. The light constituents drawn away through the pipe **20** are diluted with material return water before they come to a save-all device, and are sent through one or more supplementary cleaners where the light constituents are separated, and then they pass to the save-all.

As in the case of the apparatus described, the separation of the lighter constituents taking place in the container part **3** is less effective since the centrifugal force is less in the container part **3** than in the zone A of the container part **1**, if an effective separation of the lighter constituents is desired, the apparatus can be subdivided. The subdivision takes place preferably by the provision for the separation of the heavier constituents of a device which only differs from the one hitherto described by it not having the centrally arranged pipe **18** with the screen **19** and the exhaust pipe **20** for the lighter constituents. The outlet **22** of this apparatus communicates with the inlet **25** of a second apparatus, this if necessary with the interposition of a pump. This second apparatus which is intended for the separation of the lighter constituents consists of a container **26** the shape of which corresponds to the container part **3**. The inlet **25** is arranged at the bottom but otherwise in the same way as with the container **1**. In the cylindrical portion of the container **26**, there is a screen **27** corresponding to the screen **19** and a centrally arranged pipe **28** corresponding to the pipe or tube **18** and which is continued in a pipe **29** corresponding to the outlet **20**. The outlet of the cleaned stuff takes place through an opening **30**, concentrically arranged round the pipe **28**, and through the pipe **31**. In order to attain an effective separation of the lighter constituents, the container **26** is provided with a part **32** converging concentrically from below upwards and open to the outside, and which from the bottom upward is first made cylindrical and then conical and extends by its tip up to the level of the screen or hood **27** and thus forms with the outer container wall, an annular space.

ANDRE BERGÈS.

PUBLISHED

JUNE 1, 1943.

BY A. P. C.

A. BERGES

APPARATUS FOR THE UNINTERRUPTED CLEANING AND SIFTING, IN PARTICULAR OF PAPER-MAKING STUFF

Filed July 5, 1938

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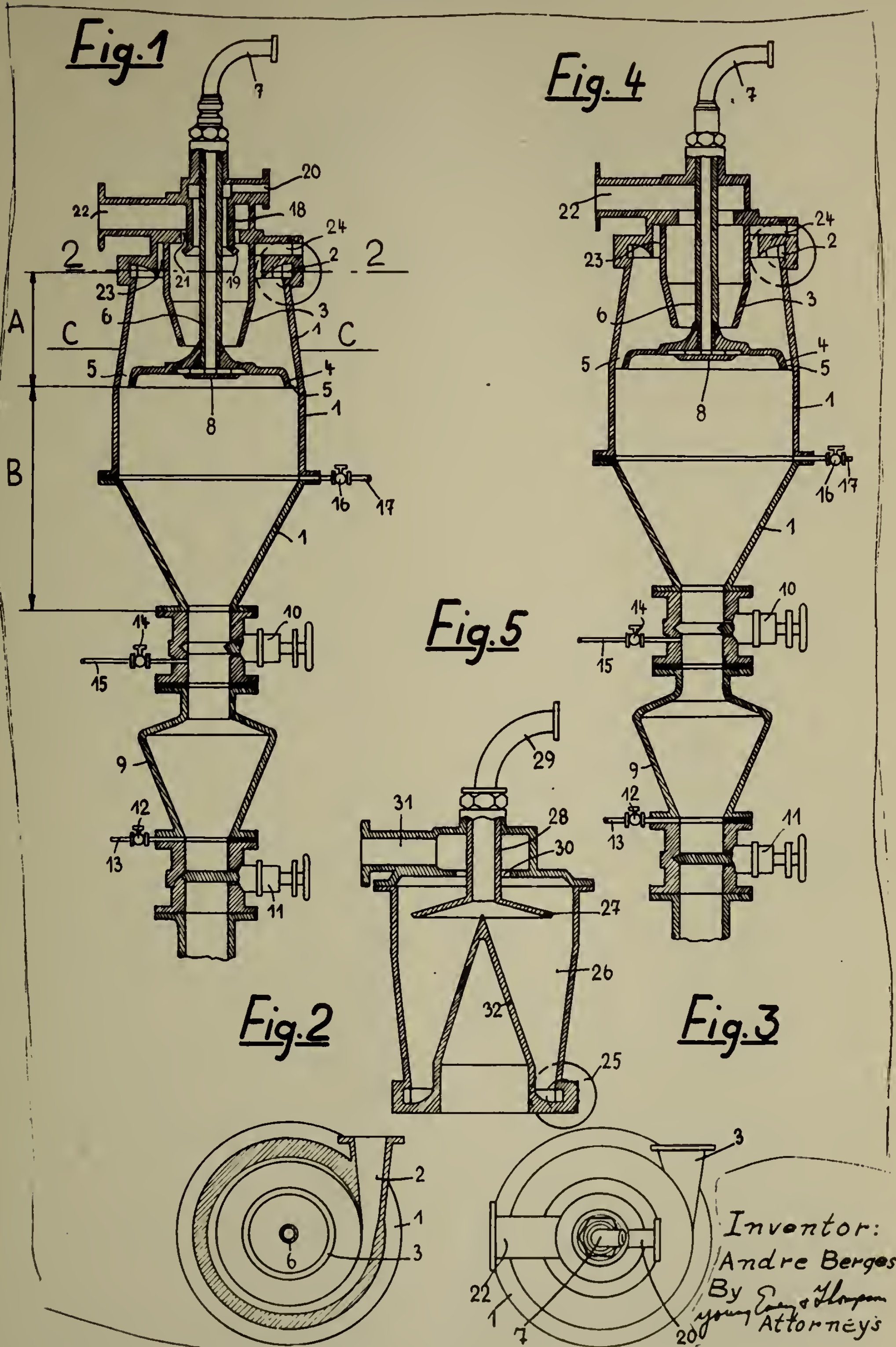

Published June 1, 1943 Serial No. 235,881

ALIEN PROPERTY CUSTODIAN

FORMATION OF THE COMBUSTIBLE MIXTURE IN INTERNAL COMBUSTION ENGINES

Prosper L'Orange, Stuttgart-Feuerbach, Germany; vested in the Alien Property Custodian

Application filed October 19, 1938

This invention relates to a method of and apparatus for the formation of the combustible mixture in internal combustion engines.

The formation of the combustible mixture in internal combustion engines by means of carburettors has the advantage that the quantity of fuel is adapted directly to the quantity of air supplied, but suffers on the other hand from the drawbacks that the fuel surface is exposed, that the carburettor is sensitive to position, and that the mixture is liable to be too rich at high speeds. The fuel pressures produced are also too low to effect sufficient atomisation, particularly if the fuel is injected into the interior of the cylinder.

With a view to retaining the above-mentioned advantages whilst avoiding the disadvantages it has been proposed to employ fuel pumps designed to give a variable supply and regulated by means of apparatus influenced by the pressure of the suction air supply. Such regulation cannot, however, be carried out sufficiently simply and sensitively.

According to the present invention the energy of flow of the air being supplied to a cylinder, which is also effective with a carburettor, is caused to act upon an overflow valve of a supply of fuel delivered in excess to a fuel injection nozzle, so as to maintain the fuel supply at a pressure proportional to the square of the velocity of the air supply, whereby the quantity of fuel ejected per unit of time from the nozzle at a constant value thereon is directly proportional to the quantity of air being supplied per unit of time.

In carrying the invention into effect the energy of flow of the air supply may be caused to act either directly upon, or by producing a partial vacuum upon, a piston or a diaphragm surface so arranged that the force acting thereon influences the loading of an overflow valve in the fuel pipe by which fuel is supplied to an injection nozzle or nozzles.

The speed of flow of the air increases in direct proportion to the quantity of air drawn into the engine per unit of time, but the air pressure thereby produced increases as the square of the speed of flow. Consequently, the load on the overflow valve, and therefore the pressure in the fuel supply pipe, increases as the square of the air speed. The injection velocity of the fuel, however, corresponds to the square root of the pressure of the supply thereof and thus is proportional to the speed of flow of the air.

The formation of the mixture in accordance with the invention can be effected whilst using either pumps with a uniform rate of delivery, for example, gear pumps, or piston pumps having a separate piston for each nozzle to be supplied. In the first case, a decisive factor in the design is whether a carburettor delivering a uniform flow of mixture to a plurality of cylinders is to be replaced, or whether the fuel is to be delivered to each cylinder individually just before or just after the inlet valve, in which event the injection valves must be controlled, but only one overflow valve is necessary for each pump. In the second case, no control of the injection valves need take place if a special overflow valve is provided for each nozzle. On the other hand, if it is desired to use a multiple cylinder pump with only one overflow valve, control of the injection valves is necessary. Such a control is frequently difficult to provide for, however, particularly when the invention is to be applied to existing types of engines.

According to a further feature of the invention, therefore, when a multiple piston pump is employed with only one overflow valve, the control of the injection nozzles is effected by the pump itself.

In order to effect such control in a simple manner and, in particular, to avoid as far as possible externally operated control members producing condensation, the piston of each pumping unit is utilised to control the communication between a pump delivery space common to all the pumping units, and a nozzle corresponding to the said piston. In this case a given piston does not operate to convey the charge delivered thereby to the corresponding nozzle, but actuates a control member which establishes a connection between the nozzle and the pump delivery space into which all the pumping units deliver, so that on the one hand a portion of the discharge of the other pumping units passes through the opened nozzle and, on the other hand, the total discharge of the piston actually operating does not pass through the said nozzle.

The quantity of fuel supplied through an open nozzle is determined by the regulated pressure common to all the pump delivery spaces and by the cross-sections of the nozzle supply passage and the injection aperture.

The overflow valve loaded by the pressure of flow can, in principle, be designed in two different ways.

Thus, according to one constructional embodiment of the invention a constriction may be provided in the suction pipe, for example by means of a so-called venturi tube, and a connection made between the position therein at which the

air has its maximum velocity and lowest pressure and the lower side of a piston or diaphragm regulating the overflow valve, the upper side of which piston is exposed to the pressure of the air in the suction pipe before reaching the constriction.

The overflow valve is thus loaded by a resultant pressure which, if necessary, may be increased by the pressure of a spring for the purposes hereafter described; the valve will therefore open as soon as the pressure of the liquid multiplied by the cross-section of the valve is greater than the resultant pressure acting on the regulating piston multiplied by the cross-section of the latter, plus the force of the spring.

The pressure of the liquid thus always remains proportional to the difference of pressure of the flowing air at the two points in the suction pipe to which the valve regulating device is connected, and this ratio can easily be made very large, as for example a thousand to one, so that a fluctuation of the air pressure produced by a variation in the velocity of the air and amounting to a few-one-hundredths of an atmosphere will cause an excess pressure in the fuel pipe amounting to several atmospheres.

The overflowing liquid is carried back into the supply tank or into the pump suction pipe.

In an alternative construction, in order to avoid the necessity for any air-sealing member, the load on the overflow valve is obtained by placing in the air-stream an obstacle, for example a plate or other deflection surface, by which the current of air is deflected.

Such an arrangement can readily be so formed that there is no considerable loss of air velocity. It can also be conveniently designed to oscillate about a pivot and be made to act upon the overflow valve through a transmission mechanism.

The injection nozzle, when it is controlled, can be closed by a valve opening inwardly or outwardly. When the nozzle is not controlled it can, particularly when the injection takes place in the cylinder, be closed by an outwardly opening needle or by a spring-loaded check valve opening inwardly. The nozzle, however, can also be quite open, especially when it discharges into the suction pipe leading to the inlet valve.

If a controlled injection nozzle is used in conjunction with a pump having a uniform output, the control may be effected by means of a mechanical control derived from the cam shaft, and conveniently from the existing control of the inlet valve.

In addition to effecting a control of the fuel supply in the manner already described it may be necessary or desirable to effect a correction of the richness of the mixture, the nature of the correction depending upon the particular circumstances or requirements, and further features of the invention are concerned with such corrections. Thus it is sometimes found that the quanttiy of fuel at higher engine speeds becomes too great as a consequence of the air attenuation then taking place, so that the mixture becomes too rich. In order to obviate this difficulty according to a further feature of the invention, the overflow valve, in addition to being loaded in accordance with the pressure of the air flow, is also loaded with an approximately constant additional force, for example by means of a spring. It is possible in this way to maintain the proportions of the mixture substantially constant.

On the other hand, in many cases, particularly in the case of aircraft engines, it may not be desired to maintain a constant mixture for all speeds and, consequently degrees of loading but to vary the mixture so as, for example, to be richer with light or full load than with intermediate loads. This variation is effected, according to the invention, by loading the overflow valve with a variable force, additional to that depending upon the pressure of the air flow, and supplied, for example, by a spring the tension of which is varied with the load. For this purpose the tension of the spring may be varied simultaneously with the adjustment of the throttle regulating the output, so that an additional initial tension is imparted to the spring when the throttle is slightly open and when it is fully open, but the tension is relieved in the intermediate position of the throttle corresponding for example, to the stage between sixty per cent and eighty per cent of the full load.

In still other cases, notably in the case of heavy motor vehicles, it may be desired that the mixture should be particularly rich at a certain speed, for example at the speed at which gear-changing takes place, and should become weaker with increasing speed. In such cases,. according to another feature of the invention, the fuel curve is corrected for example, by employing the inertia of a centrifugal regulator, by loading the overflow valve with a force, additional to that depending upon the pressure of the air flow, which is influenced by the speed and increases or decreases therewith. In this way, a mixture can be produced which is richer at low speed and at maximum speed, but poor at intermediate speeds, or which is richest at any given speed.

Another feature of the invention relates to the correction of the mixture proportions to compensate for variations of the altitude at which the engine is operating. The method of mixture formation already described ensures that the quanttiy of fuel supplied in a given time shall be in direct proportion to the quantity of air supplied in the same time, subject to any of the previously described corrections that may be applied, and provided that the density of the air remains constant. The proportions of the mixture would not, however, remain constant with variations in the altitude at which the engine is operating, since, although the fuel pressure is reduced in direct proportion to the fall in air density, the quantity of fuel supplied per unit of time varies as the square root of the air density. The quantity of fuel supplied is therefore not reduced to the same extent as the air density and the mixture thus becomes relatively richer with increasing altitude. In accordance with the invention, this fault is corrected by reducing the force loading the overflow valve as the altitude increases. This may be effected by applying an additional force having a negative action, the said force being provided, for example, by a diaphragm chamber, filled with air at normal atmospheric pressure so as to expand as the altitude increases, and arranged to reduce the load on the overflow valve when such increase takes place. If a supercharging blower is provided, the difference between the blower pressure and the external pressure may be employed to produce the variation in loading of the overflow valve, the said difference in pressure being compensated for by a spring as is more fully described hereafter.

In order that the invention may be clearly understood and readily carried into effect ref-

erence will now be made to the accompanying drawings, in which:

Figure 1 illustrates diagrammatically an engine having a fuel supply installation according to the invention which embodies controlled injection nozzles and a fuel supply pump with a uniform output;

Figure 2 illustrates an arrangement for controlling the injection nozzles;

Figure 3 illustrates an alternative arrangement for the regulation of the overflow valve in which an uncontrolled injection nozzle is used in conjunction with an intermittently discharging piston pump;

Figure 4 illustrates a modification of the invention in which several injection nozzles are supplied separately from the pumping units of a multiple piston pump and the operation of the nozzles is controlled by the pump pistons;

Figure 5 illustrates in detail a construction of a pumping unit and injection-valve control suitable for use in the embodiment illustrated in Figure 4.

Figure 6 is a diagram illustrating the operation of a fuel supply installation constructed in accordance with the invention, and one way in which the mixture proportions may be corrected.

Figures 7 to 10 are further diagrams illustrating the correction of the mixture proportions to take account of different circumstances and conditions, and Figures 11, 12, 13 and 14 illustrate various modifications of an apparatus constructed according to the invention, designed to effect the corrections illustrated respectively in Figures 7, 8, 9 and 10.

Referring to the construction illustrated in Figure 1 of the drawings, the four controlled injection valves *d* of an engine *a* are supplied with fuel from a pump *l* having a uniform rate of delivery, by means of a pipe *n* connected in parallel with the four injection valves *d*. The pipe *n* is connected to an overflow pipe *k*, controlled by an overflow valve *h*, and leading to the supply tank and thence back to the suction side of the pump *l*.

There is inserted in the air suction pipe *b* of the engine *a* a constriction *c* from the narrowest point of which a connection is made with the underside of a regular piston *f* which works in a cylinder *e* and is thus subjected on its underside to the reduced pressure resulting from the partial vacuum at the point *c* in the pipe *b*. The upper end of the cylinder *e* is connected to the pipe at a point on the inlet side of the constriction *c*. The piston *f* is thus loaded in accordance with the difference in the pressures in the pipe *b* at the point *c* and on the inlet side thereof. In addition the piston *f* is loaded by a spring *g* for effecting a correction of the fuel delivery curve in a manner more fully described hereafter in connection with Figure 6 of the drawings. These loads are applied to the overflow valve *h* which is made as a needle and closes the pipe *k* from the pump *l* until the pressure in the pipe *n* is sufficient to lift the valve *h*, whereupon a portion of the liquid flows back to the fuel tank *i* and subsequently, by way of the pipe *m*, to the suction side of the pump *l*.

The manner in which this construction operates is illustrated in Figure 6 of the drawings, in which the full line curve A′, B′ illustrates the increase of the fuel pressure *p* with the engine and air supply speeds, at a constant position of the air throttle. By taking the square roots of the values for the pressure *p* given by the curve A′, B′, a curve E′, F′ corresponding to the fuel injection velocity *v* is obtained. This curve, as can be seen, is in the form of a straight line, indicating that the fuel injection velocity increases proportionally to the engine speed.

Figure 2 illustrates one manner of controlling the injection valves *d* illustrated in Figure 1. In this construction, the valve is moved by the lever o of the cylinder inlet valve, so that it is open during the whole or a portion of the suction period. By shifting a collar *s*, the period of opening and the height of the opening movement of the valve *d* can be adjusted. The injection valve could equally well be controlled directly from the cam shaft *t* by means of cams and double armed levers. The adjustment of the valve during working (for example, to obtain a weak or a rich mixture) could then take place, for example, by adjusting the lever pin which in this case would be eccentric.

In the modification illustrated in Figure 3, the energy of the air flowing in the suction passage acts on a blade-like deflection surface *u* which, by means of a small lever arm *w*, bears upon the needle *h* of the overflow valve. The needle *h* closes a passage *k* communicating with the passage *n* through which fuel is supplied to an uncontrolled injection nozzle *d*.

The fuel is supplied by a piston pump (not shown) which supplies periodically and to excess during the corresponding suction stroke, so that there arises in the passage *n* a pressure proportional to the square of the air velocity. When the fuel exceeds this value the valve *h* opens to permit the overflow of fuel to pass by the passage *x* back to the suction side of the pump, whilst the remainder of the fuel is injected into the passage *b* through the nozzle *d*, which has a small bore directed towards the inlet valve *r* in the cylinder *a*.

The entire overflow valve and regulating device is mounted in and on a body *o* which is so fitted in a socket in the suction pipe *b* at an enlarged portion thereof that the current of air deflected by the blade *u* is caused to follow an S-shaped path.

In use, the pump is so adjusted as to commence its delivery stroke shortly after the commencement of the suction in the passage *o* and to end its delivery stroke slightly before the moment when the suction in the passage *b* ceases. During the delivery stroke of the pump, therefore, the overflow valve *h* is continuously loaded proportionally to the square of the quantity of air passing the blade *u* per unit of time.

A spring *g* is provided in this case also to effect a correction of the fuel delivery curve as described hereafter with reference to Figure 6.

The rebound surface *u* may also be made round and act directly on the needle *h*.

The nozzle opening may also be closed by an automatic valve, especially when the injection takes place in the cylinder itself.

In addition to effecting the correction described with reference to Figure 6, the spring *g* may be used to provide a supplementary load in order to compensate for a constant resistance in the injection pipe *n* or the nozzle *d*, for example, the resistance of a spring-loaded valve therein. The fuel pressure necessary for the opening of such a valve would then be determined by the spring *g* which would have to be designed to provide a force corresponding to that pressure, in addition to the force required for effecting the correction of the mixture proportions.

In the modification illustrated in Figure 4 the air suction pipe *b* of a six-cylinder engine *a* is connected to a regulating device *c*, for example of the form illustrated in Figure 1. The pressure of the fuel supply to the injection nozzles is produced by a multiple piston pump G, all the units of which discharge into the same delivery space D which is connected by a pipe *k* to the overflow valve of the device *c*. The pressure in the delivery space of the pump G is thus kept at a level corresponding to the quantity of air supplied per unit of time. The outflow of the excess fuel from the device *c* takes place through the pipe E to the pump suction pipe *m*.

The pistons L of the pump G are so adjusted that each piston reaches the end of its discharge stroke approximately at the mid point of the injection period of the corresponding injection valve.

During the compression stroke of a given piston L a pressure valve H opens, but the stroke of the said valve H is limited by a valve J, which is held on its seat by a strong spring. At the end of the compression stroke, however, the piston L positively engages the valve H and thus lifts it and the valve J by a small amount, so that during this period the pressure space D is connected to one of the pipes, I, II, III, IV, V, or VI supplying the injection nozzles *d*.

The construction of one of the pumping units diagrammatically illustrated in Figure 4 is more clearly illustrated in Figure 5. In this construction the pump housing G contains a piston guide K in which the piston L slides. In the position shown, the piston L is at the upper end of its stroke and has lifted, by means of an extension S, the pump discharge valve H and with it the control valve J, so that the passage in the union R is connected to the pump delivery space D and with the overflow valve of the regulating device *c*. The valve J is moved against the pressure of a strong spring P, so dimensioned as to maintain the valve J closed against the highest fluid pressure arising beneath it.

The delivery valve H is fitted in a screw-threaded body M which bears upon the piston guide K and is closed at the top by a cap B. The control valve J moves in a guide member O which is tightly screwed into the cap N. The height of opening of the control valve J can be determined by the thickness of a packing T.

In place of a control valve J of the form illustrated, a ground slide valve may be employed.

In each of the constructions described, since the loading of the overflow valve is derived solely from the energy of flow, the connections for utilising that energy can be made in front of or behind the air throttle. Similarly, the injection nozzle, when fitted in front of the air inlet valve, can be inserted at any position in the suction passage in front of or behind the air throttle.

As has already been pointed out, it may be necessary or desirable to correct the proportions of the mixture to take account of different circumstances. Thus, it may be found that the quantity of fuel at higher engine speeds becomes too great as a consequence of the air attenuation then taking place, so that the mixture becomes too rich. This difficulty is met by the provision of the spring *g* illustrated in Figures 1 and 3, which acts to apply an approximately constant load to the overflow valve *h* additional to the load derived from the pressure of the air flow. The effect of such additional load can be seen from Figure 6, in which the addition of the load *p*, *c* produces the final fuel pressure curve indicated by the broken line C', D'. By taking the square roots of the values given for the pressure ($p+p, c$) by the curve C', D', the curve G', H' is obtained which, as can be seen from the drawing, has a downward curve, in contradistinction to the straight line curve E', F', that is, the rate of increase of the fuel injection velocity is not directly proportional to the engine speed but decreases somewhat as the engine speed increases. It is easy by the choice of a spring of appropriate strength so to adjust this relative decrease of the fuel injection velocity as to permit the maintenance of a mixture of uniform proportions at all engine speeds.

Figure 7 illustrates a case in which the mixture proportions are corrected so that the mixture is richer with light and full load than with intermediate loads, as may be required, for example, in an aircraft engine. In the figure the continuous curve l^1 represents the variation of air pressure behind the throttle and, consequently, of the approximate air density in the cylinder, with variations in load. The curve b^1 represents the variation of the fuel supply pressure when no correction is applied, and curve b^1 being proportional to the curve l^1. The supply should, however, comply with the curve b^2, that is to say, the mixture should be richer with no load and with full load than with intermediate loads.

This may be achieved, for example, by the apparatus illustrated in Figure 11, which comprises a regulator *e*, operating similarly to the regulator illustrated in Figure 1, and having an overflow needle *h* loaded by a diaphragm *f*, the upper side of which is connected to a region of high pressure in the air supply passage, while the lower side thereof is connected to a region of lower pressure.

The said diaphragm *f* is further loaded by a spring *g*, the upper abutment of which is formed by the displaceable piston g^1 in the casing cover e^1. The piston g^1 is displaced by a cam disc g^2 and the spring *g* is tensioned as soon as the cam disc, which is connected to the throttle valve A by a connecting rod A^2 and a lever A^3, moves upon opening the throttle. As is illustrated, the cam g^2 is designed to correct the supply curve in the desired manner.

If desired, instead of employing the mechanism A^2, A^3, the correction may be effected by actuating the cam disc g^2 by means of a piston which is loaded on one side by the pressure of the air supply in front of the throttle and on the other side by a spring and by the negative pressure behind the throttle.

Figure 8 illustrates a correction which is suitable, for example, for the engines of heavy motor vehicles. In this case, the additional output and consequently the increase in the supply is provided, as indicated at b^1, at a road speed at which gear-changing takes place after which a rapid increase in the torque is necessary. The correction indicated in Figure 8 may be obtained by means of the apparatus illustrated in Figure 12 which comprises a centrifugal regulator g^3 which actuates a cam disc g^2 through a lever g^4 and connecting rod g^5 in a manner similar to that illustrated in Figure 11. When the regulator g^3 rises owing to an increase in the speed, the cam disc g^2 is thereby displaced to the left and so reduces the spring tension. When the regulator g^3 descends, the cam increases the tension of the spring and consequently the supply of fuel.

If the engine is to be used at considerably varying altitudes it is desirable to effect a correction to compensate for the change in the air density, the reduction of which from a very low altitude up to an altitude of 12 kilometres is indicated by the curve l in Figure 9. The reduction in pressure of the fuel supply, however, follows the curve b^1 if no correction is applied, and thus differs increasingly from the air pressure with increasing altitude. The present invention provides a correction of the fuel pressure whereby the curve b^2 is obtained, which provides a sufficient approximation of the fuel pressure variation to the air density variation.

A device suitable for this correction is illustrated in Figure 13, in which a diaphragm chamber f^1 is mounted on the cover e^1 of a regulator casing e of the form already described, the said diaphragm chamber f^1 acting, through a lever f^2 and a connecting rod f^3 on the regulator diaphragm and expanding with increasing altitude, due to the decreasing air density, so as to reduce the load on said regulator diaphragm.

When the engine is supercharged the correction to compensate for variations in altitude requires to be modified, and the manner in which the correction is effected is illustrated in Figure 10, in which the curve l^1 represents the reduction in the external air pressure from a very low altitude up to an altitude of 12 kilometres. By adjustment of the supercharger it is usually possible to maintain the air supply substantially at atmospheric pressure curve l^2 and b^1 until a given maximum altitude (indicated in the figure as 6 kilometres) is reached. Subsequently the pressure of the air supply decreases substantially in the same proportion as the external air pressure, as indicated by curve l^2. The device illustrated in Figure 1 of the drawings would provide a mixture of the correct proportions up to the said maximum altitude, (curve l^3 and b^1) but as indicated by the curve b^1 would then produce the same deviation as is indicated in Figure 9. If, at this point, the action of the diaphragm chamber e is replaced by that of a small piston which is loaded on one side by the external air pressure and on the other side by the pressure of the air supply, an effect can be obtained which is similar to that produced by the diaphragm chamber f^1 illustrated in Figure 13, so that the fuel curve b^1 is corrected at its right hand end to the form of the curve b^2. This result is obtained if the correcting piston is rendered operative, for example by means of the charging regulator, only when the given maximum altitude of 6 kilometres has been exceeded. However, it is advantageous for this correction also to be rendered effective before the said altitude has been attained as in indicated in Figure 10. This is due to the fact that if the air supply pressure is maintained constant up to the said maximum altitude, the quantity of fresh air charged does not remain constant, but is increased by an amount varying from approximately 20% until the said altitude is reached, owing to the influence of residual gas and temperature. By applying the correction referred to, however, the air supply pressure curve and the fuel supply curve are corrected to the form of the curve l_3 and the left hand end of the curve b_2.

Since the differential pressure increases when descending from the said maximum altitude, that is to say from 6 kilometres in this case, the arrangement also produces the correction when descending from that altitude.

An apparatus suitable for effecting the correction illustrated in Figure 10 is illustrated in Figure 14, in which a piston B and spring B^2, which are both enclosed in a cylinder B^3, act on a regulator diaphragm f, such as is illustrated in Figure 11, through a connecting rod C.

The space above the piston B communicates through a passage B^4 with the space above the regulator diaphragm f and thus with the air supply pipe in front of the throttle. The space below the piston B is in communication with the external air through apertures B^5.

At very low altitudes, no differential pressure is produced on the piston B and the spring tension effects a maximum reduction of the load on the regulator diaphragm f. At the given maximum altitude of 6 kilometres the differential pressure is at a maximum and nullifies the spring pressure. Upon a further increase of altitude, however, the spring pressure again becomes effective.

The different corrections described can be employed simultaneously; for example, the correction illustrated by Figure 7 may be employed simultaneously with the altitude correction illustrated by Figure 10. In such a case, in addition to the piston B loaded with the differential pressure, there would be a spring of variable tension acting on the regulator diaphragm and controlled as in Figure 11. Alternatively the tension of the spring B^2 below the piston B would be controlled to produce the correction indicated in Figure 7.

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4 Sheets-Sheet 1

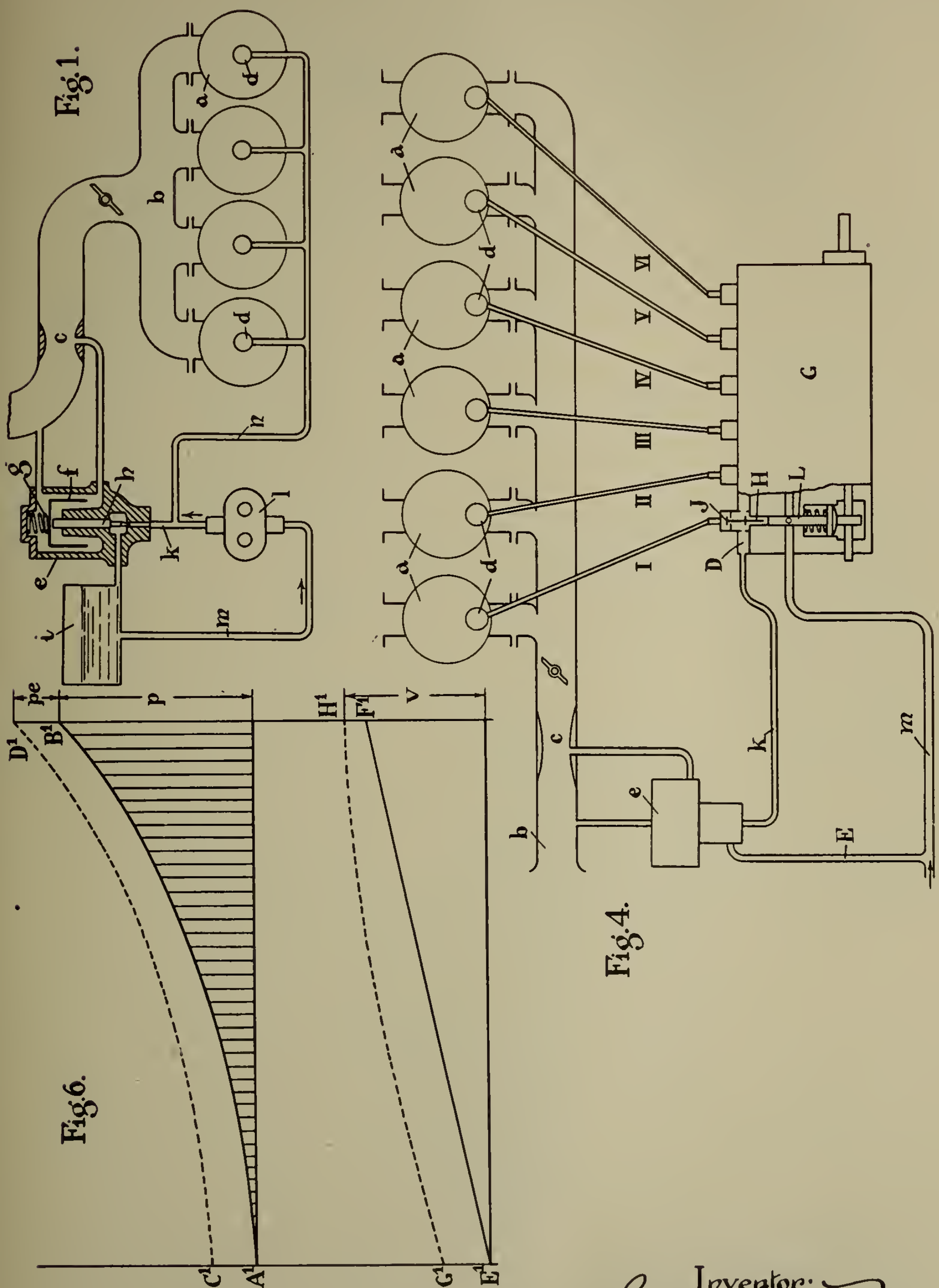

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Fig. 5.

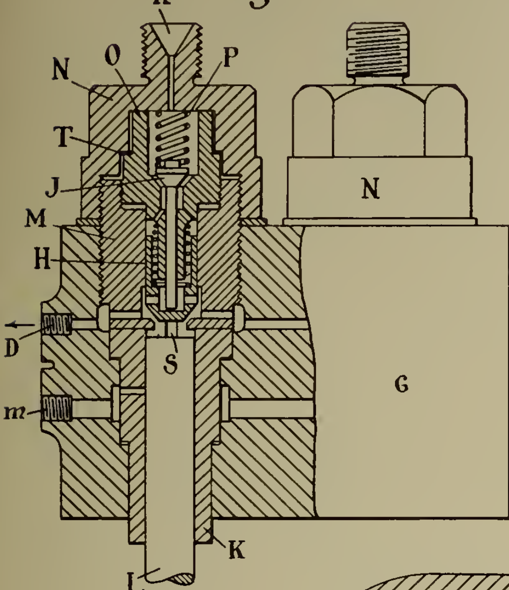

Fig. 2.

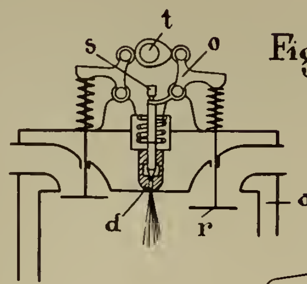

Fig. 3.

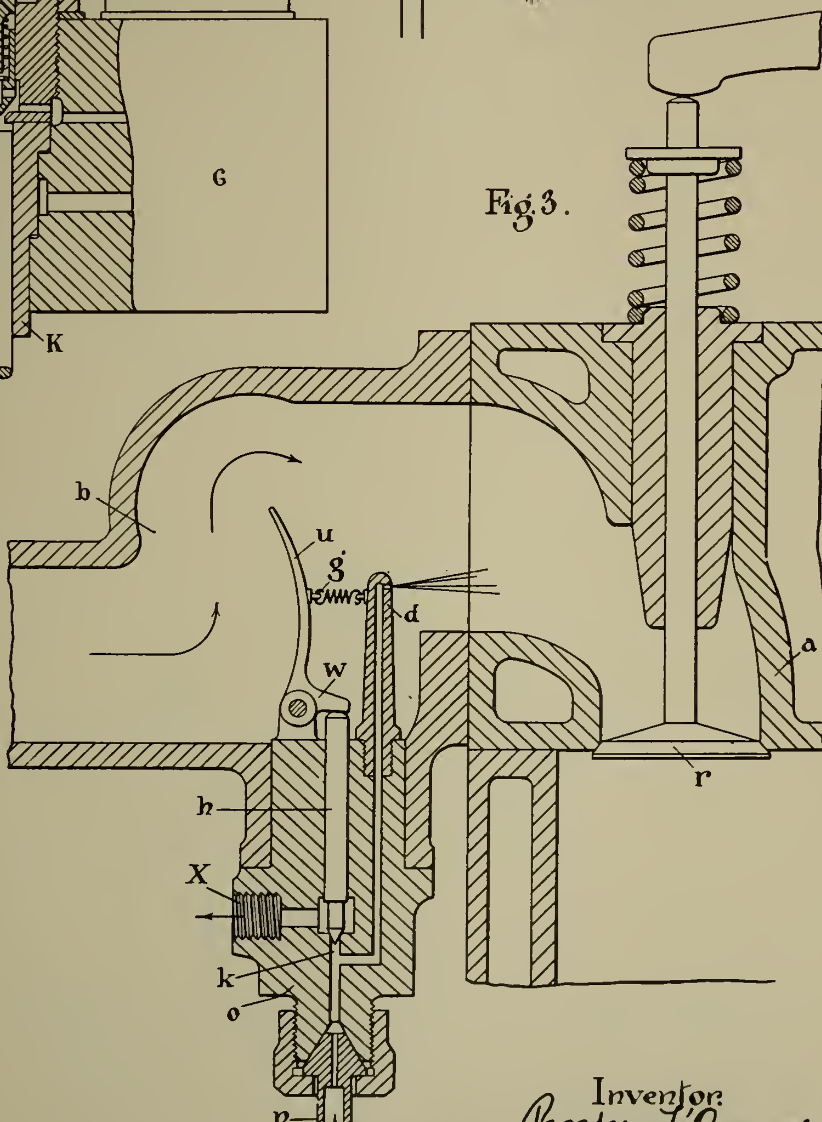

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Fig. 7.

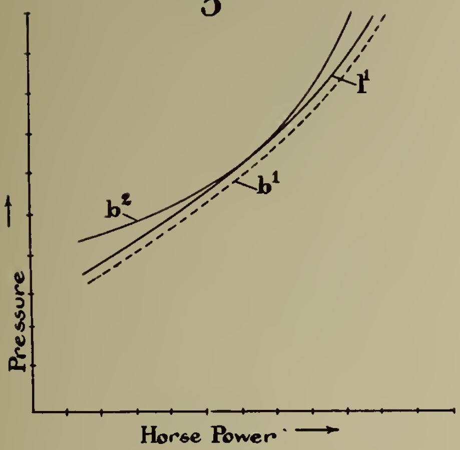

Fig. 8.

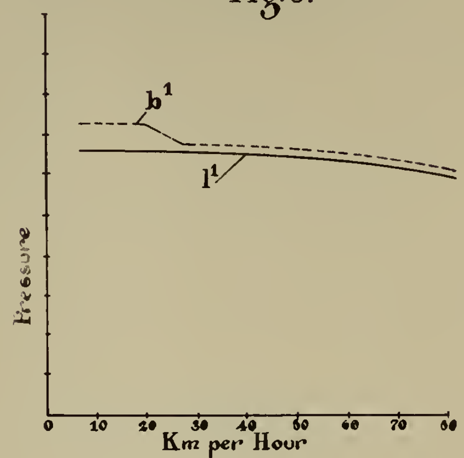

Fig. 9.

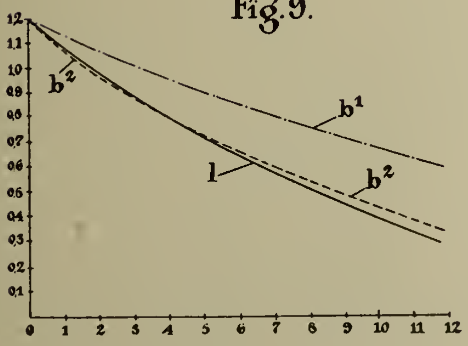

Fig. 10.

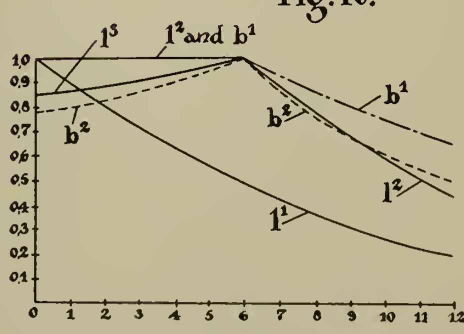

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Fig. 11.

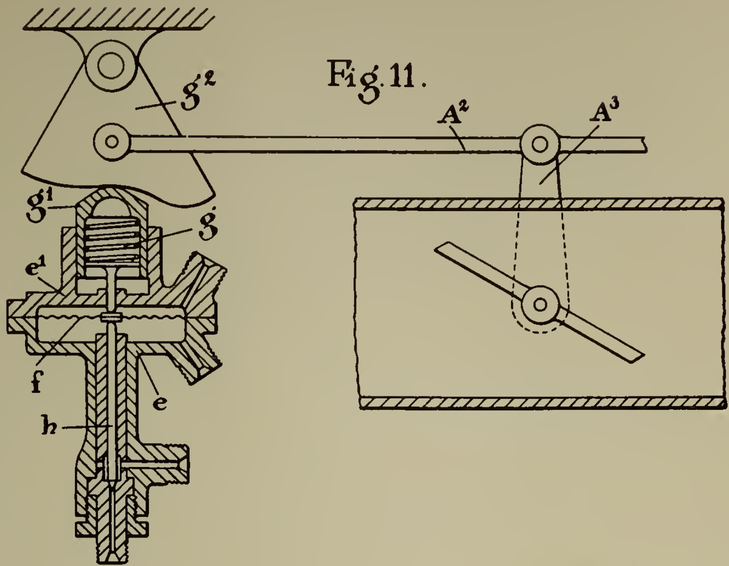


Fig. 13.

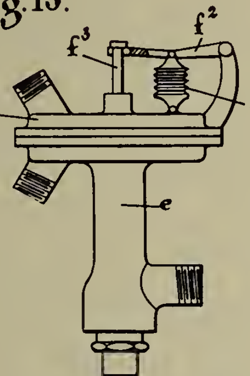


Fig. 14.

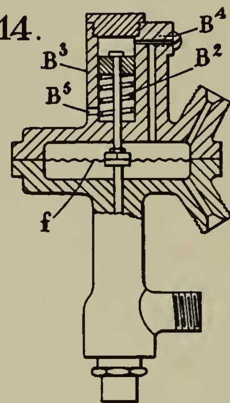
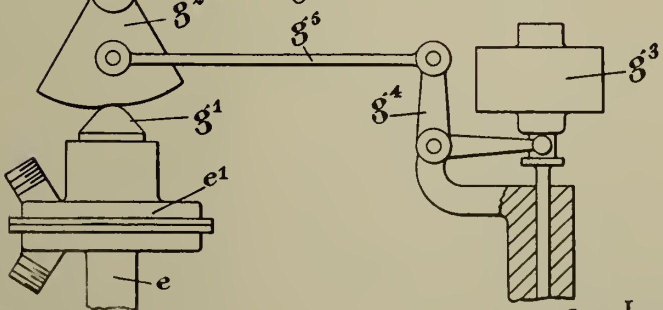


Fig. 12.



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ALIEN PROPERTY CUSTODIAN

SAXOPHONES, PARTICULARLY FOR THE PRODUCTION OF HIGH NOTES

Venanzio Incagnoli, Ceprano, Forsinone, Italy; vested in the Alien Property Custodian

Application filed October 25, 1939

In the saxophones actually used the production of high notes is made rather difficult because the keys relating thereto are placed in inconvenient positions and distant from one another. To use such keys the player has sometimes to make real efforts and undergo much fatigue.

The present invention introduces into saxophones certain devices which eliminate the difficulty mentioned above. At the same time, it introduces a new high note, corresponding to "natural A" in saxophones of the contralto type and to "natural E" in saxophones of the soprano type. The insertion of this note, however, will be optional and may be suppressed in instruments in which it is not wanted.

In a saxophone improved according to this invention the pads of the high notes are all placed one one line and precisely on the same line on which the majority of the other notes are placed; this does not occur in the saxophones used up to this day.

The pads of the four normal high notes and that of the new note, now introduced, are actuated like those of the other notes, by a single key-board by means of appropriate hollow key-steels and their respective shanks. In order that these key-steels may occupy as little space as possible, two of them lodge in their interior two thinner key-steels. To the five high notes correspond five key-steels, of which three are visible.

The single key-board common to the high notes and to a great part of the medium and low notes, as realized for the first time by this invention, is easy to work on as it comes all under the fingers of the right hand and the little finger of the left hand.

An important feature of the present invention is that the means by which the high notes are actuated, though connected with the said single key-board, are at the same time, independent of the latter and may be actuated otherwise.

In order to obtain this independence, a spatule is provided, which, located in a convenient position, allows of the closing of all the high notes whenever the player wishes to use only the medium and low notes, and the same result is also attained by means of two keys placed in other positions on the body of the saxophone.

In the annexed drawing given only as an example without limitation:

Figures 1, 2, 3 show three longitudinal views of the intrument.

With reference to the said drawing, pads **1**, **3**, **5**, **7**, **9** which close the holes through which the new note "natural A or E" and the common high notes are produced, are fixed to the shanks **2**, **4**, **6**, **8**, **10** made as second order levers whose fulcrums are all on axle **11** supported by the knobs **12** and **13**. Key-steels **14**, **15′** and **16′**, each of which is supported by its respective pair of knobs **13′—14**, **15—16**, **17—18** actuate indirectly, by means of other shanks **19**, **20**, **21**, **22** and **23**, the aforesaid pads **1**, **3**, **5**, **7**, **9**.

Key-steels **14′**, **15′**, and **16′** are hollow, and the first two, **14′** and **15′**, are double or telescopic, that is to say, they contain each a thinner key-steel. Thus one attains the object of actuating separately the single pads above numbered occupying a very small space and reducing precisely to the space of only three key-steels the space which would have occurred to arrange five key-steels.

Each key-steel and each smaller one is provided with an opening needle-spring powerful enough to overcome the resistance of the opening needle-spring with which is supplied each pad **1—3—5—7—9**. These springs, already known, have been omitted in the drawing for the sake of clearness.

The rotation of each of the key-steels **14′**, **15′** and **16′** and of the two smaller key-steels contained in key-steels **14′**, **15′**, and consequently the opening and closing of pads **1**, **3**, **5**, **7**, **9** is obtained by the intermediary of shanks **24**, **25**, **26**, **27**, **28** actuating respectively key **29** supplied with shank **30**, key **31** and its shank, and pad-keys **32**, **33**, **34**. The pad-keys just mentioned are the same as already exist in the ordinary saxophones, inasmuch as they serve to form the medium and low notes.

When it is desired to prevent the opening of the pads corresponding to the holes of the high notes, the player can move with the ring-finger of his left hand spatule **35**, supported by the knobs **36**, **37**, which actuates, in the manner that will be indicated, a double-hinge bridge **38** without spring, placed above shanks **2**, **4**, **6**, **8**, **10** in a sense transversal thereto. Spatule **35** is supplied in its lower part with a spring **39** which tends to keep the said spatule in a raised position. Tail **40** of spatule **35** strikes then with its end under said bridge **38** and keeps it adherent to shanks **2**, **4**, **6**, **8**, **10**. Thus the high notes will be obtained only when spatule **35** is lowered.

The same result may be attained by means of key **41** actuated by the thumb of the left hand and supplied with an opening needle-spring, which with its shank **42**, that overlays shank **43**, which can be actuated directly by key **44**, urges upwards shank **45**, and through the latter actuates bridge **38**. Spatule **46**, by means of its key-steel **47** and

shank 48 which overlays shank 43, serves to close the pads of the high notes when, such pads being open, it is desired to give out only medium and low notes.

For the production of high notes, therefore, it is sufficient to press any of the said keys 35, 41, 44.

The fingering of the instrument for the production of the four normal high notes and of the new note "natural A or E" is the following: For Sopranino, Contralto, Baritone and Contrabass saxophones, natural F is obtained by pressing with the index of the right hand, F diesis with the middle finger of the right hand, natural G with the ring-finger of the same hand, G diesis with the little finger of the same hand touching the second key towards the lower part of the two keys already existing in the ordinary saxophones, "natural A" with the little finger of the left hand. For the Soprano, Tenor and Bass saxophones, by using the same fingering as above one obtains, in the place of natural F, natural C, in the place of F diesis C diesis, in the place of G natural D natural, in the place of G diesis D diesis, in the place of the new note "A natural" "E natural".

VENANZIO INCAGNOLI.

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JUNE 1, 1943.

BY A. P. C.

V. INCAGNOLI

SAXOPHONES, PARTICULARLY FOR THE PRODUCTION OF HIGH NOTES

Filed Oct. 25, 1939

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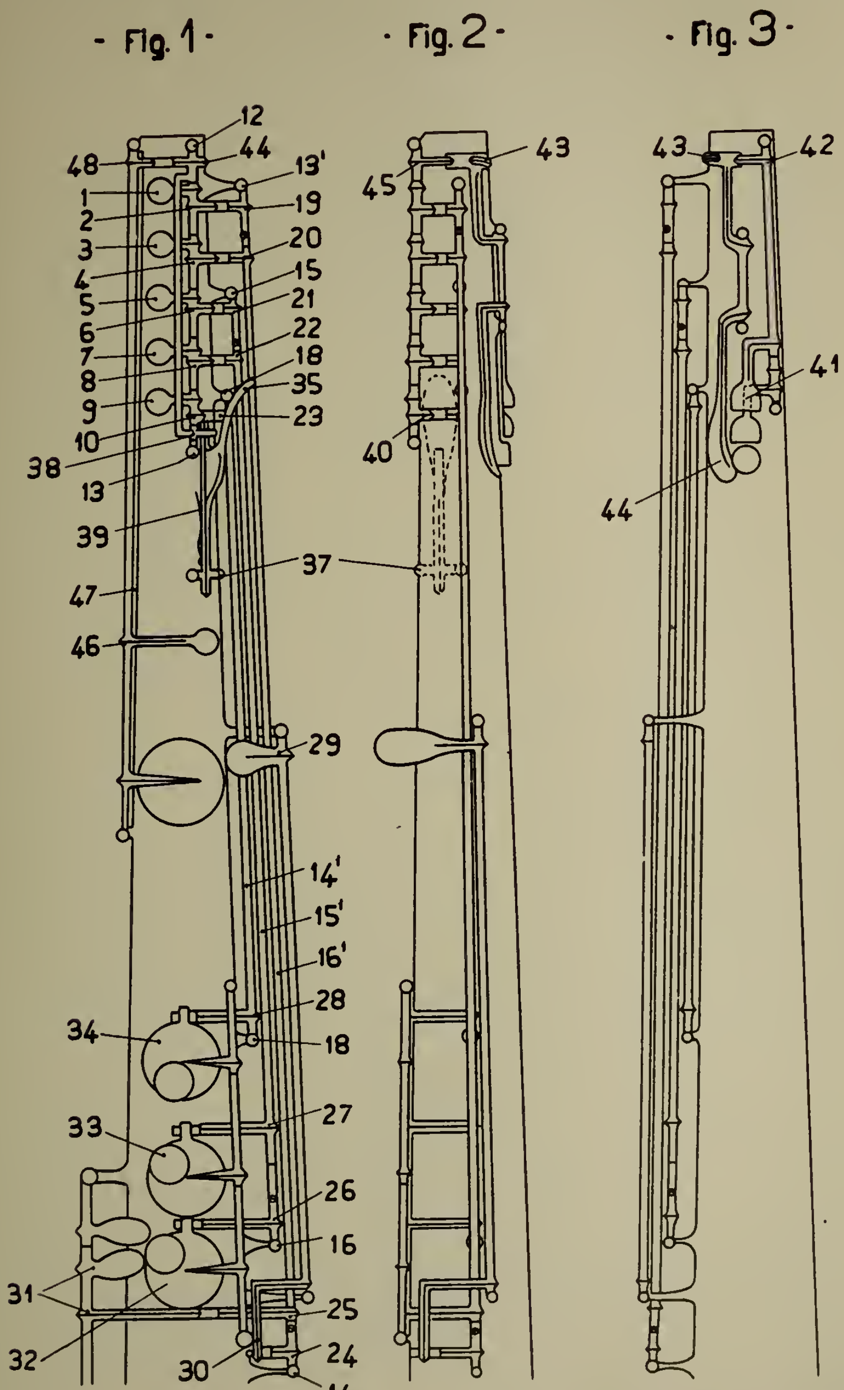

Inventor

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Serial No. 238,976

ALIEN PROPERTY CUSTODIAN

COATING OF OBJECTS OF MAGNESIUM OR THE LIKE WITH OXIDES

Ernst Krause and Ernst Schröder, Leipzig, Germany; vested in the Alien Property Custodian

No Drawing. Application filed November 5, 1938

This invention relates to the production of surface layers of oxide on objects made of magnesium or of alloys consisting principally of magnesium by anodic treatment in alkaline solution.

As compared with the process hitherto known the process according to the invention differs essentially in that the anodic treatment is carried out in aqueous alkaline solutions of oxides of such metals as have an amphoteric character, e. g. in solutions of alkali aluminates, arsenates or zincates. The protective layers obtained from such solutions are distinguished by high resistance to corrosion, great hardness and density, and good insulating power.

Preferably the alkalinity of the solution is maintained at a pH number of about 10 to 13 and the solution is kept at an elevated temperature, e. g. at a bath temperature of 30° to 70° C.

Since on long use of the bath due to changing the objects suspended therein, and due to carbonate formation the alkalinity of the bath has a tendency to fall, the desired high alkalinity must if necessary be maintained by the addition of free alkali.

The anodic oxidation can be assisted according to the invention, by the addition of oxygen carriers, e. g. by the addition of small amounts of cerium sulphate, or of tungstates or chromates.

It has been found that the protective layers of oxide which are obtained by anodic treatment in baths of known composition can be considerably improved as regards density, hardness, insulating power and resistance to corrosion by a finishing treatment or a preliminary or intermediate treatment in baths composed according to the invention. For obtaining high insulating power the treatment in such baths as contain alkali arsenates has been found to be particularly advantageous while moreover solutions of alkali aluminates produce specially favourable results. The solutions of these salts offer also the special advantage that the metal (Aluminium) is not cathodically deposited.

The conductivity of the baths is so regulated by suitable regulation of the concentration and temperature that the process is worked with currents of 1 to 3 amps per sq dm. By a large increase in the bath temperature e. g. to 60 to 85° C. there is obtained dark or deep black coloured protective layers.

This colouration is probably to be ascribed to certain foreign metals in the magnesium or magnesium alloys. Instead of this, the protective layers obtained according to the invention can subsequently be coloured with organic or inorganic dyestuffs, or coated with lacquers.

The protective layers can also be sealed and hardened by treatment with water glass and subsequent heating to about 150° C.

As examples of suitable bath compositions may be mentioned:

Example 1

Water	litre	1
Sodium aluminate	grams	200
Cerium sulphate	do	3

If desired acid or alkali additions are made thereto until the desired pH value is obtained.

Temperature 40° C.

Example 2

Water	litre	1
Sodium arsenate	grams	200
Cerium sulphate	do	3

If desired alkali or acid is added thereto until the desired pH value is obtained.

Temperature 50° C.

The process can be carried out using direct or alternating current. Whilst hitherto in the superficial oxidation of magnesium and magnesium containing alloys, alternating current had to be used, and advantage of the new process consists in that sufficiently strong protective layers can be obtained by the use of direct current under relatively low voltages e. g. 10 volts and with current densities which are about as high as those usual in the anodic oxidation of aluminium in aqueous solutions.

The protective layers obtained according to the new process produce also on profiled objects a good corrosion resistance and possesses a high absorptive power for sealing agents such as water glass.

On account of the capability of the protective coating of being produced in thick layers the corrosion protection is especially good since thick layers are capable of absorbing correspondingly more sealing agent.

ERNST KRAUSE.
ERNST SCHRÖDER.

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ALIEN PROPERTY CUSTODIAN

VEHICLE BODY CONSTRUCTION

Erwin Komenda, Stuttgart-Korntal, Germany; vested in the Alien Property Custodian

Application filed November 26, 1938

This invention relates to an improved vehicle body construction and more particularly to a vehicle body formed with integral air ducts for cooling and/or heating various vehicle parts.

An object of this invention is to provide a vehicle body containing air cooling and/or heating ducts formed as an integral part of the body construction.

Another object of this invention is to provide air cooling and/or heating ducts for a vehicle body, formed with a minimum of added parts.

Still another object of this invention is the provision of a vehicle body made of individual interconnected sheet metal members which, at the same time, form air cooling and/or heating ducts.

An object of this invention is the provision of air cooling and/or heating ducts for the engine, passenger compartment, or windshield of a sheet metal vehicle body, formed from the hollow spaces already present in such a body.

A more specific object of this invention is the provision of air cooling and/or heating ducts for the engine, passenger compartment, and windshield of a vehicle body formed from the hollow spaces within the body walls, windshield posts and roof rails of such a body, preferably made from interconnected sheet metal parts.

Other objects and advantages of this invention will be apparent from the description of a single preferred embodiment thereof taken in connection with the attached drawing, wherein:

Fig. 1 is a side view of a vehicle body formed in accordance with the principles of this invention;

Fig. 2 is a transverse cross-sectional view along the line II—II of Fig. 1;

Fig. 3 is the half of a transverse cross-sectional view along the line III—III of Fig. 1;

Fig. 4 is the half of a transverse cross-sectional view along the line IV—IV of Fig. 1; and

Fig. 5 is a transverse cross-sectional view of part of the construction shown in Fig. 3, drawn upon an enlarged scale to emphasize certain features of my construction.

The principles of this invention are illustrated generally in Fig. 1 as applied to an automobile of the type having its engine in the rear. The vehicle body is illustrated as being formed of a front apron **1** having a wheel insert **2** and interconnected with a roof portion **4**. Windshield posts **6** are provided at the front edge of the roof **4** and the roof is itself supported by roof rails **7**. The latter extend rearwardly into the side walls **8** which is formed with rear wheel inserts **9**. The body is supplied with the usual floor board **28** forming with the interior of the body the passenger space **29**. The engine space at the rear of the body has been indicated at **30**. It is to be understood that preferably all of the body elements are formed from sheet metal and, more specifically, in accordance with the teachings of my co-pending application Serial Number 236,633, filed October 24, 1938, of which the present application is a continuation-in-part. The principles of my construction are not, however, limited in their application to this specific type of body which has been used merely by way of illustration.

The body arrangement described above adapts itself admirably to the formation of integral hollow ducts extending longitudinally of the vehicle for carrying fresh or cooling air to the passenger compartment or engine, or for carrying heated air from the engine compartment to the interior of the vehicle or to openings directed against the windshield. As best shown in Fig. 2, taken in connection with Fig. 1, I prefer that the fresh air be drawn in through a suitable opening in the side of the vehicle, such as the opening **33** positioned in the wheel insert **2**. An opening so positioned is subjected to a certain amount of natural air pressure, developed when the vehicle is traveling, which will tend to blow the air through the ducts to the positions desired. For guiding the entering air, duct **34** is first readily formed between the hollow portions existing by the arrangement of the apron **1** and the interior strengthening leaf **11**. The boundaries of the duct may be completed by insertion of small transverse leaves, such as **40**.

Extending rearwardly, the duct **34** merges into the duct **35** which is formed by the hollow space bounded by the apron **1**, the windshield post **6**, the strengthening leaf **11**, and the transverse leaf **40**.

The duct **35** will then extend upwardly through the hollow windshield post **6** and will there merge into the connecting duct **31**.

As best illustrated in Fig. 3, the duct **31** is formed from the natural hollow space existing between the roof **4** and the sheet metal roof rail **7**. No additional parts are necessary to form this passage.

Toward the rear of the vehicle where the roof rail extends into the sheet metal side walls **8**, the duct **31** is formed by the hollow space bounded on opposite sides and at the bottom by the outside wall itself and the inner lining **19**, as shown in Fig. 4. The top of the duct at this

point consists of the transverse roof strengthening member 17. At this rear portion of the vehicle the duct 31 will communicate with the rear engine space 30, and there may be interconnected in any suitable manner so as to guide cooling air to the engine itself. It will thus be seen that the various hollow spaces 34, 35, and 31 will, with the addition of extremely few parts, form a continuous air conducting duct from the front of the vehicle back to the rear engine. While such has not been illustrated, it is within the scope and concept of this construction that suitable means be provided to forcibly draw the air through this duct in addition to the natural draft caused by pressure at the opening 33.

If it is desired to provide heated air to the passenger compartment or to play upon the windshield to prevent the formation of frost or ice, a similar duct 32 extending forwardly from the rear of the vehicle may be provided. This duct can be formed by the connection of the roof, roof rails, and side walls similarly to the duct 31. As shown in the left hand portion of Fig. 2, the duct 31 will connect with a duct 36 formed in the windshield post by the apron 1, the strengthening leaf 11, the windshield post 6, and the transverse member 41. At the lower end of the windshield post 6 preferably in the vicinity of the floor board 28, a suitable opening 39 may be provided through which the heated air may pass into the interior of the vehicle. At the position of the windshield, slits 37 may be provided in the windshield post 6 for properly directing the heated air against the windshield. In Fig. 1, the direction of the cooling air has been indicated by the arrow in solid lines while the direction of the heated air has been indicated by the arrow in dotted lines.

The manner in which the air may be heated at the rear of the vehicle is of unimportance with regard to this invention but it may be done in any of several manners known to the art. For example, the air may obtain its heat from the engine exhaust, from the hot engine cooling water, or by some separate air heating device which may be regulated to control the temperature of the air supplied. Suitable air filtering means (not shown) may also be used for both the cooling and heated air.

It is furthermore contemplated that a suitable blower (not shown) may be supplied for propelling the air forwardly to the windshield and/or body interior.

Since the cooling or heating air is liable to contain moisture or other ingredients which may affect and rust the interior of the ducts, it is advisable that these be so formed that they are accessible for cleaning or covering by paint. To that end, the ducts may be preferably formed with small slits indicated in Fig. 3 as 42, in Fig. 4 as 43, and still more clearly shown in Fig. 5. By means of a special device the ducts may be cleaned or sprayed through these slits or, if the body is painted by the dipping method, the slits permit entry and withdrawal of the paint from the ducts. After the painting operation has been performed, I prefer to cover these ducts with suitable compressible means indicated at 44, such as soft rubber, artificial resinous material, or felt. This material may be in the form of pads which at certain places within the vehicle body can advantageously cover the edges 45 of the interior decorative covering 46. The parts will press against the edges and thus tend to hold them in place by a clamping action.

While in the form of invention illustrated and described above only two ducts have been shown, it is obvious that others formed in accordance with the principles of this construction may be utilized, if desired. Variations in the duct system are also apparent. For example, the cooling air may lead directly into the passenger compartment and an opening from that compartment may lead through a duct back into the engine space. Although the engine has been described in connection with a rear engine vehicle, the duct system can readily be adapted to those constructions in which the engine is positioned forwardly. In the same manner, the invention is applicable to other types of vehicles such as railway cars, motor boats, etc. One of the advantages of my arrangement is that constructional space and cost is saved by utilizing the body elements themselves to form the air conducting passages. It is possible, however, that if thought desirable, these passages may be formed of separate thin sheet metal elements such as, for example, aluminum sheeting; or even cardboard. This arrangement will work very satisfactorily and will not consume much more space or add much more weight if at least one side of the ducts is formed by the vehicle body parts already present.

ERWIN KOMENDA.

PUBLISHED	E. KOMENDA	Serial No.
JUNE 1, 1943	VEHICLE BODY CONSTRUCTION	242,526
BY A. P. C.	Filed Nov. 26, 1938	

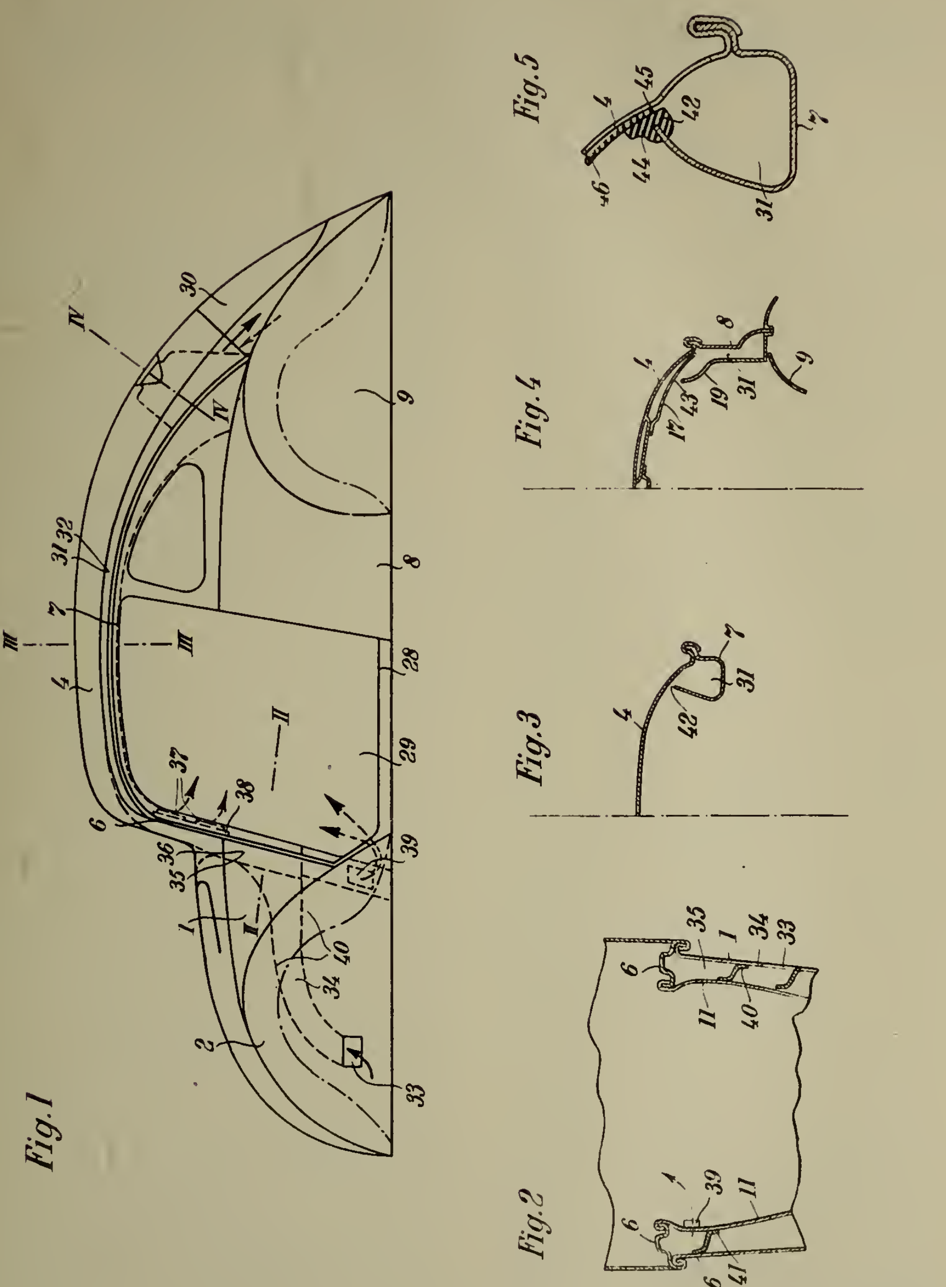

Fig.1 Fig.2 Fig.3 Fig.4 Fig.5

Inventor:
Erwin Komenda
by
Attorneys

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ALIEN PROPERTY CUSTODIAN

AIR CONDITIONING SYSTEMS

Aldo Gini, Milan, Italy; vested in the Alien Property Custodian

Application filed January 16, 1939

This invention relates to air conditioning systems, or rather systems destined to provide, not only for the desired temperature and humidity in living rooms, but also for the conditions of the air purity requested by the hygiene.

The invention relates more particularly to a method that is adapted to obtain in an economical way the desired conditions of the air purity, the efficiency of the system varying according to the number of persons that pollute the air.

It is known that, if the temperature and humidity that control the changing of the warmth of the human body have to be maintained within opportunely chosen limits by means of a good system, it is not less important to maintain the air in conditions of the necessary purity, without useless wastage.

The common systems with automatic control generally used, consider but the control of the first two elements and neglect the third one completely, referring for this one to the most requested exigencies; and consequently it happens, for instance, that in rooms that may be empty or crowded, many systems with automatic control maintain certainly the conditions of temperature and inner humidity, but do not control the air enough in a uniform way, a control that has to account essentially for the principal reason of the air pollution, which is produced by the persons. The means that allow to obtain this purity in dwelling rooms are:

(1) The filtration that has the purpose of restraining the particles that remain in suspension and which may be independent of the number of the persons and therefore does not require any automatic control.

(2) The washing of the air to extract and restrain from it certain substances emitted by the persons that impart them disagreeable smell and confer them other qualities hurtful to people's health, however not well defined.

(3) The air renewal to substitute partially the spoilt inner air with the pure outside air.

It is obvious that, with regard to an economical operation these latter two processes have to vary according to the number of persons; the more the room is frequented, the greater is the necessity of washing and renewing the air and, as the renewal and the air conditioning cause considerable operating expense, it is of greatest importance that this is done in the required measure; the renewing of the air of empty or not much frequented rooms in the same proportions as when the room is crowded is very expensive, whilst, on the other hand, it would be antihygienic, if the renewal in crowded rooms had to be limited too much. The inconveniences that come from intrusting such a regulation to manual operating are obvious, as it is done with the ordinary systems. In my opinion they are greater than those that may come from lack of automatic control of the temperature, because, whilst the variations of this latter are noticed immediately by those that are present, the air pollution is perceived but with great retardation.

The main object of the present invention is to provide for a controlling device, adapted not only to control automatically the inner temperature and the humidity of the rooms, but also to maintain the air purity at the desired degree, by varying the air renewal and the quantity of washed air according to the inner pollution due to the persons or to other causes.

Another object of the invention is to provide for a system that allows to give the precedence to whatever factor interesting the air conditioning: temperature, humidity and purity; and not only that, but it is possible to vary the order of precedence, regulating opportunely the degree of influence of the particular controlling devices on the operation of the system.

And more precisely, the invention relates to a controlling system for an air conditioning system, in which the registers that control the outside air inlet and the recirculated air, are driven by direct or indirect impulses furnished by thermostats or humidostats placed into the rooms to be conditioned, so as to obtain that the air renewal and the quantity of purified air result in proportion to the pollution (for instance the number of persons that are present) and that with both, heated or cooled air systems.

It is evident that the operating of the said controlling system will have to vary according to the fact, if it is question about cooling or heating systems; in fact, the effect of the presence of persons with regard to the temperature is summed up to the one obtained with the system when heating, whilst when cooling said effect results opposed to the one obtained by operating of the system, for which the impulses that drive the opening and the closing of the outside air inlet in a heating system may be generated directly or indirectly by thermostats placed into the room to be conditioned, when the temperature of the latter is rising. With the summer operating, however, the rising of the temperature, caused by the persons, cannot be utilised directly, because this rising cannot be distinguished from the one which is caused by the transmission from out-

side, for which it is necessary in this case to utilize as an impulse giving element the humidity brought in by the persons, or even more rationally as impulse giving conditions may be used those that are established in a standardizing cell having adjustable characteristics of thermic inertia and dispersion, said cell being heated or cooled directly or indirectly with the same means that heat or cool the room to be conditioned.

The operation of the system is as follows: the conditions of the cell and of the room to be conditioned are adjusted, when the room is empty, so that the same temperature is established within them; this may be obtained by arranging the cell position opportunely and regulating its thermic inertia, the transmitting coefficient of the walls and the amount or the temperature of the heating or cooling fluid.

In the room to be conditioned a thermostat is placed, which, by driving the registers, the valves and similar, maintains the temperature in the room constant; under these conditions the temperature in the cell has the same value, if the room is empty or little frequented, but if sensible heat is brought in for causes that do not happen in the cell, as this is the case with crowds, the temperature in the cell will have an inferior value, due to the preliminary adjustment, for which this less temperature may be utilized as impulse giving element for the automatic renewal control, as the decrease is the greater the greater is the crowd. Therefore the drive of the register of the outside air inlet may be obtained by means of a thermostat placed into the cell, so that, if the temperature in the cell is decreasing under a certain value corresponding about with the temperature of the room, the renewal from outside is augmented; the renewal control may be obtained also by an impulse due to the difference between the temperature of the room and that of the cell.

It is evident that this latter system that utilizes the standardizing cell, may be applied, not only for the control of a summer system, but also for a winter system.

In order that the invention may be more fully understood, there are described by way of example and with the aid of the accompanying drawings some constructive forms the invention may assume.

Fig. 1 is a typical diagram of a heating and conditioning system with gradual or "modulated" control, according to the invention.

Fig. 2 is an analogue diagram, but with a controlling system having two positions, according to the method "on and off."

Fig. 3 is a diagram of a conditioning system adapted to operate in the summer season, as it has to be provided for the cooling of the air and with a system of gradual control.

Fig. 4 is an analogue diagram to Fig. 3, but with controlling system having two positions.

Fig. 5 is a diagram of a conditioning system utilizing the standardizing cell.

Referring first to conditioning systems combined with winter heating systems, and particularly to Fig. 1: **1** is the outside air inlet, **2** is the circulating air inlet, **3** and **4** are the heating apparatus, **5** is the air washer and **6** the ventilator. The automatic control is obtained as follows: **7** is a thermostat that controls by means of the valve V3 the heating fluid inlet (water or vapor) into the heating apparatus **3**, **8** is a thermostat that controls by means of the valve V2 the inlet of the same fluid into the foreheating apparatus **4**, so that the heated air of this one has always a determined temperature, for instance 15° C, somewhat inferior to that of the room. The valve V3 that drives the heating apparatus **3** when the heating fluid inlet is the most open, for deficiency of temperature in the room, moves the registers **9** and **10** that control the outside air inlet and the recirculation, by means of a contact or relay, so that the first is closed and the second open, and at the same time it closes the washing device (for inst. nozzles) of the washer **5**. This operation of the register may be driven, rather than by a supplementary contact, in another way, direct or indirect by the temperature of the room, also with gradual or so called "modulated" control.

If the desired temperature has been reached in the room, for inst. 20° C, the registers **9** and **10** are moved in the inverse sense, through which the outside air begins to enter again, and the temperature of the air flowing into the room is reduced automatically in this way. If the room is empty, there is a renewal minimum from outside, as the room is going to get cool more quickly, as soon as the renewal has begun. If, however, there is a crowd, the temperature (of 18° C for inst.), at which the register **9** that controls the renewal from outside is closed, is reached more or less quick, according to the smaller or greater number of persons; and then the renewal is controlled automatically, according to the crowd; but not only that, but the influence of the persons is the greater the higher is the outside temperature, for which reason the renewal augments with this latter, renewal which answers to a hygienic and operation economical criterion.

In the above described system the temperature receives the precedence with regard to the air renewal and the washing. And the control of the humidity may have the precedence over the washing, if, as in Fig. 1, the opening of said washing device is driven also by the humidostat U placed into the conditioning room.

The temperature of the heating fluid feeding the heating apparatus **3** and **4** is controlled automatically or by hand, in a well known way, according to the outside temperature.

To reduce the temperature of the air coming in from outside, when the renewal is augmented automatically, the heating of the radiator can be interrupted completely or partially. In this latter case the radiator is divided into two sections, the one being driven directly by the thermostat that is in the room, and the other, for inst., by a supplementary contact connected with the register **9**.

The diagram of Fig. 2 is like that of Fig. 1, but it shows a system where the registers may assume only two positions: on and off; **1** is the inlet of the outside air; **2** is the inlet of the recirculated air; **3** is the heating apparatus; **4** is the ventilator; T′ is the thermostat placed into the room, which drives the two registers B and C, and at the same time it controls the register A, the efficiency of the heating apparatus **3** and the washing device. These latter may be driven, not only by the thermostat T′ through the valve D, but also by the humidostat U through the valve D_1.

The operation of this system is as follows: when the temperature of the room sinks under a certain predetermined point (for inst. 18° C), the thermostat T_1 opens the register B and closes the register C, bringing contemporarily the regis-

ter A into the position A_1, whilst the washing device gets closed. So, the outside air does no longer enter and the temperature of the room augments. If, for inst., the 20° C are overpassed, the thermostat T_1 will move the register A, in order to let in the outside air, whilst B gets closed partially and C opened. The valve D, also driven by T_1, sets the washing again in efficiency, whilst the engine Q reduces the action of the heating apparatus **3** at a minimum.

It is obvious that, if the room is crowded, its temperature rises rapidly and the outside air inlet will be kept open nearly continuously, so that the air in the room is maintained very clean.

In the system represented in Fig. 3, which is adapted to summer conditioning, A is the register that controls the entrance of the outside air; B is the register that controls the entrance of the circulating air; T is the thermostat placed into the conditioning room, which drives the register A and B; T′ is an analogue thermostat (that may be also not distinguished from T) that controls the quantity of cooling fluid flowing to the cooling apparatus R_1, and T″ is a thermostat, placed as indicated in the figure, that drives the registers C and D, in order to maintain the temperature of the cooled air constant. The humidostat U, placed as well into the room, may drive also the registers A and B and control the heating apparatus **R2** like the thermostat T′.

As the temperature of the room exceeds the predetermined limit, the thermostat T closes the register A and opens the register B of the circulated air, whilst T′ brings the operation of the cooling apparatus R_1 to a maximum, and the thermostat T″ maintains the temperature of the cooled air constant, controlling in this way the absolute air humidity.

So, humidity is given the precedence with regard to temperature, which is of particular importance for the summer systems. To give the precedence to temperature, it suffices to interchange the operation between the two thermostats T′ and T″. The thermostat T″ that maintains the temperature of the cooled air constant, may be substituted by another one that keeps the temperature of the water at the discharge of the cooling apparatus, constant.

The air washing is done in a known, independent and continuous way, by means of a suitable device (nozzles etc.).

When the lowest preestablished temperature is reached in the room (for inst. 25° C), the registers A and B may be driven also by the humidostat U and precisely if the air is very humid (for inst. a relative humidity above 55%), the humidostat U is tending to open the register A and to close the register B and allows the operation of the heating apparatus **R2** that has to dry the air. If, however, the temperature limit is hardly reached, the thermostat T′ keeps still open the cooling fluid inlet into the apparatus R_1 and blocks the drive of the heating apparatus R2, which the humidostat U was going to drive.

If there are no persons after a certain time, there will be noted a sinking either of the humidity or of the temperature in the room; in the first case the humidostat U tends to close the register A of the outside air and to open that of the recirculated air, and at the same time to hinder the heating of R2. If then the temperature sinks below a certain limit, the thermostat T′ will limit the cooling fluid inlet and allows the operation of the heating apparatus **R2**, which, however, cannot work, being prevented from by the humidostat U, whenever there is lacking humidity (as it happens when there are no persons); if, however, there would be a crowd, the humidity degree of the cooled air being maintained constant by the thermostat T″, the humidity and the temperature would augment in the room; to keep this latter constant, provides the thermostat T′, augmenting the passage of the cooling fluid through the cooling apparatus. In consequence of the augmented humidity the humidostat U will move the registers A and B, in order to augment the outside air renewal; but it may happen that, for inst., the heating fails in the room due to the heat interchange with outside or to the heat supply of the illumination; then, the humidity degree determined by the thermostat T″ would no longer be suitable, but then the heating apparatus **R2** starts, driven by T′, if the temperature of the room is always under the predetermined point and the humidity is somewhat higher. With these dispositions the desired effect is obtained.

In order to make the system more sensitive and to hasten the return to the interchange position, when there is lacking inner humidity, and to economise refrigerating fluid, when the humidity is high, there may be provided for an indirect drive of the thermostat T″, which controls the humidity degree, so that this latter rises when the humidity in the room is low and falls when it is high. The control may be obtained by means of either two position registers or gradually moving registers; with this accessory control, however, the proportion of the washed air is decreased in case of considerable inner humidity.

The diagram of Fig. 4 shows a system like Fig. 3, but its registers have but two positions; on and off; **R1 R2 R3** are various cooling apparatus, whereof the first two with parallel connection, whilst the third has series connection and cools but the outer air. The control is such as to keep constant the temperature of the water leaving the cooling apparatus. At a determined inner temperature in the room, for inst. 25° C, at the beginning of the operation, the inner temperature of the room being above the prescribed, the thermostat **T1** closes the outside air inlet and opens the circulating air inlet, and at the same time B remains open and C closed. The room gets cooler unto the determined temperature (25° C); then the thermostat lets enter the outer air in the desired measure, whilst B remains open and C closed; if the humidity is high, it does not happen anything else; if the humidity is low, the outside air inlet is closed. When a temperature of 24° C, for inst., is reached, B is partially closed and C is opened. If the humidity is high, which means the presence of many persons, then the heating apparatus R opens, and the outside air inlet remains open. It is to note that, when this latter is opened, the temperature in the cooling apparatus **R1 R2** sinks and the humidity degree of the air sinks automatically. If the humidity of the room is low, the radiator R does not get heated, and the outside air inlet remains closed until the humidity does not rise and falls again into the precedent cycle with renewal from outside.

All the described controls solve the problem when the potentiality of the system is sufficient. Nevertheless it may happen that conditions of exceptional climate and minor efficiency of the system appear, through which this latter may result insufficient. In such a case it may be convenient to reduce the renewal from outside, for which purpose a supplementary control may be used, with which, as the inside temperature exceed

the desired value, the outside air inlet is limited, independently of the other controls, by means of a register driven by a thermostat.

In Fig. 5 is shown a diagram of a conditioning system utilizing a standardizing cell 7, in which the heating (or the cooling) is obtained with the same fluids that heat (or cool) the room to be conditioned. 1 is the outside air inlet, 2 that of the recirculated air; 6 is the air heating (or cooling) element; T' is the thermostat placed into the room to be conditioned, which maintains its temperature constant (in the case of the figure this is reached by controlling the two registers 3 and 4); 7 is the standardizing cell that is heated or cooled by means of the same fluids that heat or cool the room: they may be either the air pushed by the ventilator 5 or the fluid traversing the heating or cooling apparatus 6. T2 is a thermostat placed into the cell 7 that controls the opening of the two registers 1 and 2, so that, if the temperature in the cell is tending to sink, the register 1 tends to get more open and the register 2 to get closed, with a gradual movement that may be driven, for instance, by an electrical or pneumatical device.

Though in the foregoing description have been described and shown some concrete forms, which the systems, being object of the present invention, may assume, it is understood, however, that different modifications may be brought to them, by those who are expert in this art, without for that departing from the scope and spirit of the present invention.

ALDO GINI.

PUBLISHED

JUNE 1, 1943.

BY A. P. C.

A. GINI

AIR CONDITIONING SYSTEMS

Filed Jan. 16, 1939

Serial No.

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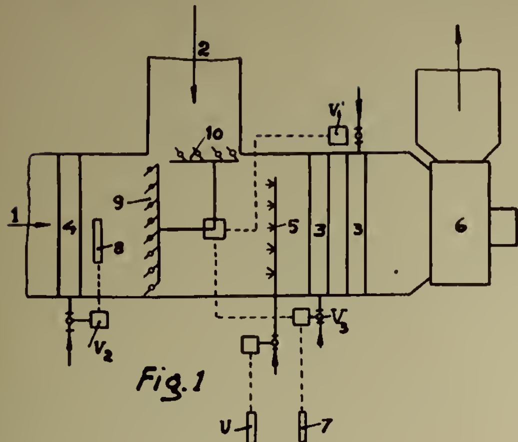

Fig. 1

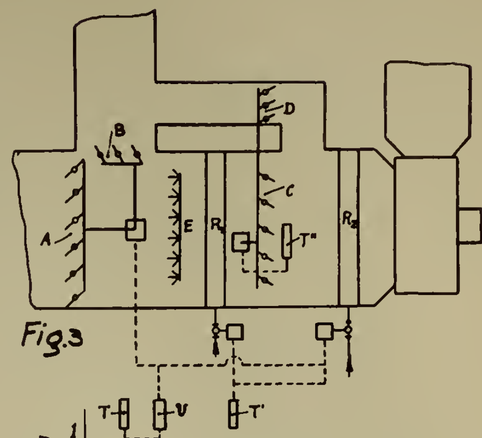

Fig. 3

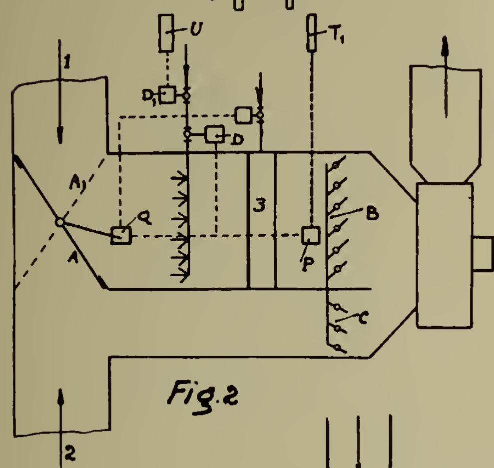

Fig. 2

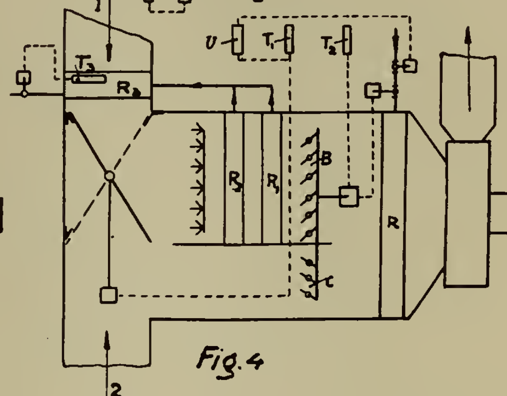

Fig. 4

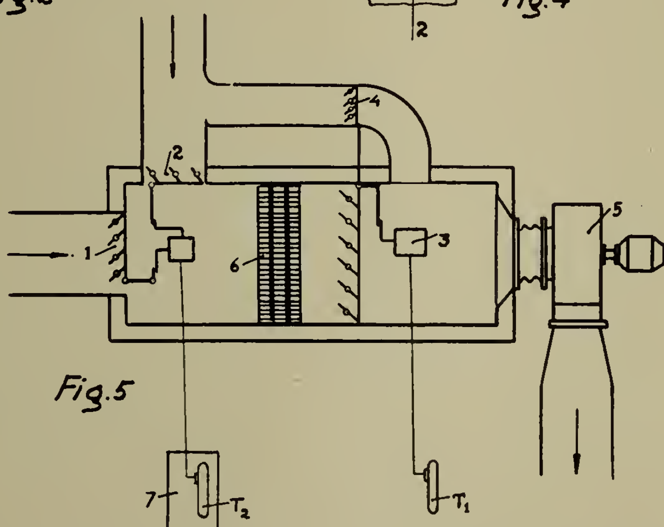

Fig. 5

Attorney

Inventor

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ALIEN PROPERTY CUSTODIAN

LIGHT METAL FIRE EXTINGUISHING

Arthur Schubert, Schonebeck-Elbe, Ernst Söcknick, Dessau-Alten, and Wolfgang Kutscher, Leipzig, Germany; vested in the Alien Property Custodian

Application filed January 19, 1939

This invention relates to a method of preventing and extinguishing light metal-fires and to fire extinguishers which may be used in connection with said method.

It is an object of the invention to provide methods and means by which any light metal-fires, produced, for instance, by machining of light metal, more particularly, magnesium, parts or by self-ignition thereof under action of water or the like or by any other cause can be extinguished safely and quickly, or prevented, respectively.

A special object of the invention is to avoid any detrimental effects produced by the extinguishing and to prevent any re-ignition of the light metal.

As is well known, fires of light metal are very difficult to be extinguished. Usually, sand or the like is used for this purpose, but high precision machines, such as turning lathes and the like are spoiled and rendered inoperative by such use of sand. Moreover, it cannot be prevented that the fire remains alive for a certain period of time so that re-ignition occurs very often on removal of the sand. Similar results were experienced where other known fire extinguishing materials were used. For example, on removal of the sand from the light metal parts, glowing nests are found under the sand.

We have now found that light metal-fires can be extinguished very quickly and without any detrimental effects by covering the burning light metal parts with oil, more particularly with oil of a high flash point. Although oil on its part is also a combustible material, it was found to produce a sudden extinguishing effect upon burning light metal parts, without the formation of a blazing flame. Our invention, therefore, comprises broadly the use of oil as a fire extinguisher for light metal.

By way of example, ordinary waste oil of the kind drawn off from a motor has been poured over burning light metal scrap; the fire was extinguished immediately, without any fiery tongues or blazing flames being formed. After a certain time, the light metal scrap was spread out and found to be cold and free from burning or glowing nests or portions, respectively, and re-ignition of the light metal is effectively prevented.

We prefer the use of oils or oil mixtures derived from distillates of a high flash point, whereby the oil is prevented from taking fire in the extinguishing operation. However, even where relatively easily combustible oil of a low flash point is used, the said extinguishing effect is obtained with respect to the light metal fire.

Indeed, it may occur in this case that the oil itself catches fire, but such oil-fire can be easily extinguished. Care must be taken, however, that the oil is not removed from the light metal parts which have just been extinguished and are still hot, since the light metal tends to catch fire again. On the other hand, where fire extinguishing materials like carbon tetrachloride or methyl bromide are used to extinguish the burning oil-fire, the oil coating is removed from the light metal by action of such materials and the light metal might catch fire again if it is not yet cooled down sufficiently. Therefore, a certain period of time should elapse before such oil extinguishing materials are applied or before the oil is removed from the light metal.

It will be understood that the admissible flash point of the oil depends on the special use of the same, more particularly on the extension of the fire to be extinguished and the size of the burning parts, and the flash point should be as high as possible with large scale fire or pieces, while oil of a lower flash point may be used to extinguish small pieces.

Our novel light metal-fire extinguishing method is very useful, the more so as certain quantities of oil are always available in factories where light metal-fires may occur. Also, the usual fire extinguishing agents for oil-fire are available in such works, so that where oil-fire should occur in special cases, it can be easily extinguished with the available extinguishers. Furthermore, when entering into the interior of any machines or apparatus in the extinguishing operation, the oil does not spoil the machines like sand or other chemical extinguishers, but it merely adds to the lubricant used in the respective machine. For this reason, also, our light metal-fire extinguisher may be used as a protective liquid in the machining of light metal parts so as to prevent ignition thereof and, when used for this purpose, it will act as a lubricant reducing friction and as a cooling agent at the same time.

We contemplate also the use of additions to the oil which serve to enhance its flash point and/or tend to prevent its ignition or exert an extinguishing effect with respect to the oil. Additions enhancing the flash point of the oil are, for example, tricresyl phosphate and pyranol (see Holde, "Kohlenwasserstofföle und Fette," page 263). On the other hand, known oil extinguishing agents, such as, chlorinated hydro-carbons, carbon tetrachloride, methyl bromide and

the like may be used as additions to exert an extinguishing effect with respect to the oil, but not more than 5 percent and preferably only 2 to 3 percent of such agents should be added.

It is also contemplated that the oil used in the light metal-fire extinguishing may be blended with diluents which are inert with respect to the light metal, in order to reduce the expenses of the extinguishing agent. Various substances which are soluble in oil or vice versa or miscible therewith may be used for this purpose, provided that the respective substances per se are inert with respect to the light metal ignition or become inert when combined with the respective oil. Typical examples of suitable diluents are tar oil or creosote, pyranol and tricresyl phosphate.

Furthermore, we have found that sulfur is a very useful addition which is inert with respect to the light metal ignition or rather even enhances the inert properties of the extinguishers. It appears that sulfur when added to oil not only enhances the flash point but also acts as an extinguishing agent. This may be explained in this manner that sulfur dioxide is formed in the combustion which has a favourable effect and decays or suffocates the flame.

We add the sulfur to the oil by dissolving it therein. As is known, about 2 percent by weight of sulfur are usually soluble in oil which quantity is normally sufficient for the present purpose, but the percentage of sulfur may be increased by the use of so called auxiliary solvents, i. e., solvents or mixtures of solvents in which both sulfur and oil are soluble.

Solvents of this kind are known in the art for dissolving various substances and therefore, it will not be necessary to specify such substances.

Another way to dissolve larger quantities of sulfur in the oil would be to use an oil which has a particularly high dissolving capacity for sulfur. Especially, components of mineral oil which are rich in aromatics are very suitable for this purpose. For example, more than 2 percent and up to 7 percent sulfur can be dissolved in a component of mineral oil which is rich in aromatics and has a specific weight of 980 grs per liter. The said oil is characterised by the fact that it tends to form resin at low temperatures, under action of monohydrate.

The said sulfur-containing oils may be used in this form but we have found that in general it is advantageous to use also additions of chlorinated hydrocarbons, such as, carbon tetrachloride or methyl bromide which may be applied in comparatively small percentages of about 2 to 3 percent and not more than 5 percent.

It will be understood that since practically any kind of oil and more particularly waste oil can be used in our novel fire extinguishing method, our novel fire extinguishing agent may be produced at very low expenses. According to a very important feature of the invention the said substance may also be used for preventing the ignition of light metal when it is machined, for instance, in the form of a liquid which is continuously applied in the boring or other cutting operation. Especially in the latter case great percentages of any of the above mentioned diluents may be added to the oil for economic and other reasons.

Our novel fire extinguishing agent may be applied upon the burning light metal parts or chips in any suitable manner which renders it possible to spread or spray or pour the oil over the burning light metal parts and to cover the same with oil. Any known apparatus or devices may be used for this purpose and by way of example, two devices are illustrated diagrammatically in the drawing.

Referring to the drawing, an ordinary watering can **1** is filled with our novel fire extinguishing agent **2** which is discharged through its mouth piece **3** and spread over the fire occurred in a scrap box **9** filled with light metal chips **5**. In the same figure there is also shown a fire extinguisher of conventional design, comprising a casing **6** and, comprised therein, a chamber **7** for a suitable compressed gas, and a second chamber for oil **2**, if desired with suitable additions of the kind above referred to. The oil is sprayed unto the fire by opening a valve **4** between the two chambers and allowing the gas to force the oil through the mouth piece **8** which may also be filled with a valve, if desired.

We wish to make it clear that while various substances other than those above mentioned provided that they are miscible with, or soluble in, oil may be added thereto in order to produce the above mentioned effects, aqueous emulsions of oil with or without additions of gas producing substances and silicates are not suitable liquids for our novel method since said aqueous emulsions cause explosion phenomena in the fire extinguishing process and tend to permit or even to cause re-ignition of the light metal due to the presence of water in the emulsion.

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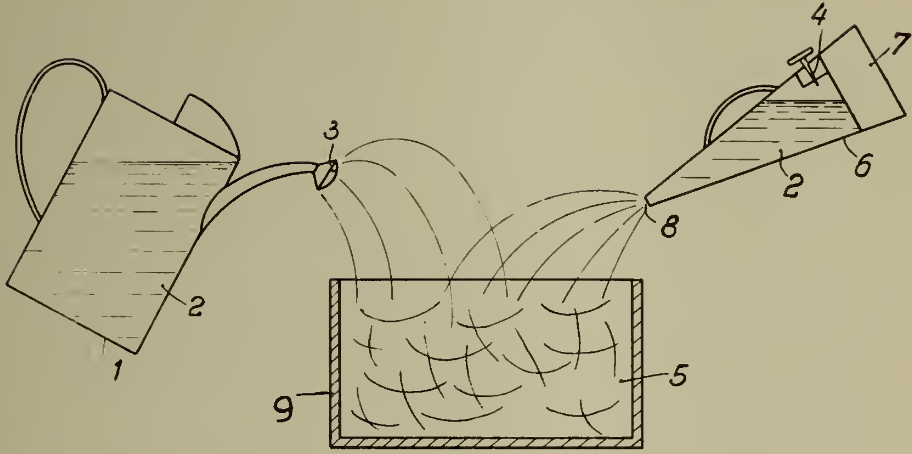

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ALIEN PROPERTY CUSTODIAN

METHOD AND MEANS FOR REMOVING OILS AND OTHER EXTRACTS

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Application filed February 11, 1939

This invention relates to a method and means for continually extracting oils and other substances.

In the course of a continuous lixiviation or extraction of various materials, such as oils, fats and other soluble extracts, it is very difficult to provide a transportation of the material subjected to extraction which would be uniform, and free from interruptions or other disturbances. It is necessary, however, that the material be transported through the extraction solution over a comparatively long path, the extraction solution usually flowing counter current to the direction of movement of the material.

In prior art extractors, reciprocatory pistons or pipes were used for the purpose of moving the material step by step, and these pistons or pipes transmitted their pressure either directly upon the material subjected to extraction or employed frictional forces to cause it to move along with them.

An object of the present invention is to eliminate the inconveniences and disadvantages of these prior art methods and to provide a simple and easily operable method and means for continuously extracting oils, fats and other substances.

Another object of the present invention is the provision of a device for continually extracting oils and other substances wherein the extraction process is carried out in a simple hollow pipe which does not contain any transporting screws, pressure pistons or other transporting devices.

Other objects will be apparent during the course of the following specification.

It was found that small amounts of liquid projected with a comparatively great force and having the effect of short, powerful blows to which the extraction solution is subjected at suitable places, have the effect of readily transporting, step by step, the material situated within the extraction solution from its place of entry to the outlet. This effect takes place even when the extraction solution flows counter current to the material.

The objects of the present invention may be realized, therefore, through the use of a purely hydraulic pressure operating intermittently in the form of short powerful thrust-like blows upon the extraction solution and transmitted to the material through that extraction solution and not through the use of any auxiliary mechanical means.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawings showing by way of example, a preferred embodiment of the inventive idea.

In the drawings:

Figure 1 is a diagrammatic view, partly in section of an extraction device constructed in accordance with the principles of the present invention.

Figure 2 shows a portion of the device for producing hydraulic blows, upon an enlarged scale.

Figure 3 is a section along the line **3—3** of Figure 1, on a larger scale; and

Figure 4 is a section along the line **4—4** of Figure 1, on a larger scale.

The device illustrated in the drawings comprises a hopper **10** having an upper opening **11** into which the material **12** to be subjected to extraction is introduced.

The lower opening **13** of the hopper **10** is connected with a long vertical pipe **14**, the lower end of which is situated within a cylindrical casing **15**.

The casing **15** also carries one end of an elongated horizontal pipe **16**, the opposite end of which is connected with a casing **17**. The casing **15** encloses a filter **20** which is a standard wash-filter and consists of a filter mass which is enclosed between two sieve surfaces while a thin layer of the filtered material which covers the surfaces of the sieves operates as the final filtering medium. This filter operates as a solvent remover.

A pipe **45** has one end provided with a nozzle **46** which is carried by the casing **15** and the filter **20** and which projects into the inflow opening of the pipe **16**.

The casing **15** is carried by a container **22** which is supported by a column **39**. The interior of the container **22** is in communication with the pipes **23**, **36** and **41**. The outflow pipe **23** carries a valve **24**. The pipe **36** carries a drop valve **37** and is connected through a valve **43** (Fig. 2) with the interior of a container **44** enclosing an end of the pipe **45**.

The valve **37** connects the interior of the pipe **36** with a chamber **38** situated below the column **39** and connected by a pipe **40** with a pump **35** which is also connected with the pipe **41**.

The column **39** which is situated between the container **22** and the valve **37** is used merely as a support for the container **22** and does not provide a communication between the chamber **38** and the container **22**.

The pipe **16** constitutes the actual extraction chamber. It has smooth inner walls and does

not contain any transporting devices or the like.

The pipe 16 should be of such length that the material 12 moving through the pipe with a predetermined speed should be subjected to extraction for the required period of time.

While the pipe 16 is shown as being straight in the drawings, it may be curved or bent in any suitable manner or may have the form of a sinuous curve. Care must be taken, however, that all of the parts of the pipe 16 should lie in the same horizontal plane.

However, in order to be able to overcome frictional forces better, it is advisable to incline the pipe 16 to a small extent in the direction toward the container 17. Whenever specifically light extraction means, such as benzene, benzol, or ether are used, the pipe 16 should be inclined downwardly in the direction toward the container 17, while in the case of specifically heavy solvents such as tri-, tetra-, etc. the pipe 16 should be directed upwardly.

Due to the simplified method of transporting the material 12, the process of the present invention, is particularly suitable for specifically light solvents, for instance, solvents which are lighter than the material 12.

The casing 17 which supports the opposite end of the extraction pipe 16, is enclosed by another casing 18 which is provided with an out-flow pipe 19. A filter 21 provided with upper edges 25, is substantially similar to the filter 20 and is situated within the casing 17. The filter 21 is used to remove the solvent still adhering to the material 12 and cause a return of that solvent, into circulation.

The pipe 16 is supported by bearings 28 of a container 26 which is carried by a pipe 51.

An upper container 29 is connected with the container 26 by a vertical pipe 30 and a valve 31 having a float 32. A pipe 49 connects the container 26 with a pump 48 which is connected by the pipe 50 with the pipe 51.

A steering cock or valve 55 situated within the pipe 51 is driven by the motor 56 (Fig. 3) and is connected with a pipe 52 having a nozzle 47 projecting into a vertical pipe or casing 57 situated below the filter 21 within the casing 17.

A short-circuit pipe 53 carrying a valve 52 connects the container 26 with the container 51.

In operation, the material 12 to be extracted is introduced through the opening 11 into the hopper 12, and drops through the vertical pipe 14 into the interior of the filter 20.

As will be described in greater detail hereinafter, the blows of the liquid ejected through the nozzle 46 cause the material 12 to move step by step through the extraction pipe 16. The pressure of the liquid ejected through the nozzle 47 causes the treated material to rise vertically in the pipe 57 and the filter 21 and to drop over the edges 25 of the filter 21 into the outflow pipe 19.

A concentrated oil or extract solution known as "Miscella" flows through the filter 20 into the container 22, and may be removed therefrom for further use either intermittently or continually through the pipe 23 carrying the valve 24.

The residue liquid remaining in the material 12 after the latter has passed through the extraction pipe 16, is removed in the filter 21 before the residue is caused to drop over the edges 25 of the filter 21 into the space between the containers 17 and 18, and is removed from that space through the outflow pipe 19.

The solvent removed in the filter 21 is returned to a container 26 by an angular pipe 27 which connects the filter 21 with the container 26.

The container 26, which also serves as a support for the long extraction pipe 16, receives continually a fresh supply of solvent from the container 29, the supply being regulated by the valve 31 having the float 32.

The amount of solvent flowing through the valve 31 into the container 26 corresponds to the amount of liquid removed through the pipe 23.

There is a difference in level between the liquid situated in the filter 21 and the liquid situated in the filter 20, this difference being represented by the letter h in Figure 1.

Due to this level difference, the extracting solvents are driven through the material 12 situated in the pipe 16 in counter current to the direction of movement of this material.

As already stated, the nozzles 46 and 47 are used to transport the material 12 through the device by ejecting intermittently out of their pipes 45 or 52 small amounts of liquid with the greatest possible original velocity, i. e. with a great kinetic energy, into the current of the comparatively slowly flowing extraction means. Each of the nozzles 46 and 47 has the form of a shower head provided with many openings. The nozzle 46 extends horizontally at the inflow end of the horizontal pipe 16 and is used for the horizontal transportation of the material 12, while the nozzle 47 is situated beyond the outflow end of the extraction pipe 16 and extends vertically, since its purpose is to transport the material 12 upwardly through the pipe 57 and the filter 21.

The intermittent blows exerted by the liquid ejected through the nozzles 46 and 47 shift the material 12 rhythmically through the device until it falls by gravity over the edges 25 of the filter 21 into the outflow pipe 19.

Many suitable devices may be used for the purpose of ejecting small amounts of liquid with high initial energy through the nozzles 46 and 47.

In the device illustrated in the drawings, a hydraulic ram is used for the purpose of ejecting liquid through the nozzle 46, while a steered shut-off valve is used to eject the liquid through the nozzle 47.

In actual practice, however, it may be advantageous to use similar devices for operating the two nozzles.

The hydraulic ram operates as follows:

The liquid situated in the container 22 is driven by the pump 35 through the pipe 36 and toward the drop valve 37 which is normally open (Fig. 2). The liquid flows through the valve 37 into the container 38 and thence through the conduit 40 into the casing of the pump 35, and is transported through a pipe 41 back into the container 22.

As soon as the liquid flowing through the pipe 36 has reached a certain predetermined speed, it presses the body 60 (Fig. 2) of the valve 37 upwardly until the valve body 60 closes the openings 61 and thus interrupts the communication between the pipe 36 and the chamber 38.

Then the liquid column remaining in movement in the pipe 36 strikes against the valve body 62 of the valve 43 situated between one end of the pipe 36 and a container 44, and opens the valve 43. Then a comparatively small amount of liquid will flow rapidly upwards through the container 44 and the pipe 45 into the nozzle 46, and will be ejected out of the nozzle 46 into the

extraction pipe 16, the effect of this liquid being that of a sharp swift blow.

As soon as the kinetic energy of this amount of liquid has been used up, the valve body 60 of the valve 37 drops downwardly again and the valve 37 is opened, thus permitting the pump 35 to cause a circulation of liquid through the valve 37, the chamber 38 and the pipes 40 and 41. When the circulating liquid reaches a predetermined speed, the valve 37 is again closed and the same operation is repeated.

Thus the hydraulic ram operates periodically and automatically, without the assistance of any steering devices, the effect of the ram being that of periodically repeated blows, exerted by a liquid of comparatively small volume but high initial energy. Due to the great kinetic energy of the liquid a good blow-like effect is attained.

The hydraulic blows transmitted by the nozzle 47 are produced by means of a steered shut-off valve. The pump 48 transmits the solvent situated in the container 26 through the pipes 49 and 50 into the container 51. The valve or cock 55 situated in the container 51, is rotated by the motor 56 (Fig. 3), so that periodically and intermittently a communication is established between the container 51 and the pipe 52 carrying the nozzle 47.

The safety valve 52 carried by a pipe 53 is normally closed. When the pressure of the solvent is too high, the valve 52 opens automatically and causes a portion of the solvent to flow upwardly from the container 51 through the pipe 53 and into the container 26.

Due to the rotation of the valve 55, small amounts of liquid having a high kinetic energy penetrate the pipe 52 and are ejected upwardly through the nozzle 47, thereby moving the material 12 upwardly within the filter 21 and causing it to fall off the edges 25 of the filter 21 and into the outflow pipe 19.

Thus the material 12 is transmitted through the extraction pipe 16 by hydraulic pressure devices situated at both ends of the pipe 16. The nozzle 47 in addition to pressing the material 12 upwardly also creates suction at the outflow end of the pipe 16.

It is apparent that the specific illustration shown above has been given by way of illustration and not by way of limitation and that the structures above described are subject to wide variation and modification without departing from the scope or intent of the invention. For example, many other suitable hydraulic pressure devices may be substituted for the ones described and in addition to those shown, further hydraulic pressure devices may be provided within or alongside the pipe 16. The material removed through the outflow pipe 19 may be reintroduced into the same device in order to further the extraction operation. It is also possible to connect in series several of the devices of the type illustrated in the drawings. All of the above and other variations and modifications are to be included in the scope of the present invention.

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H. SÜSS
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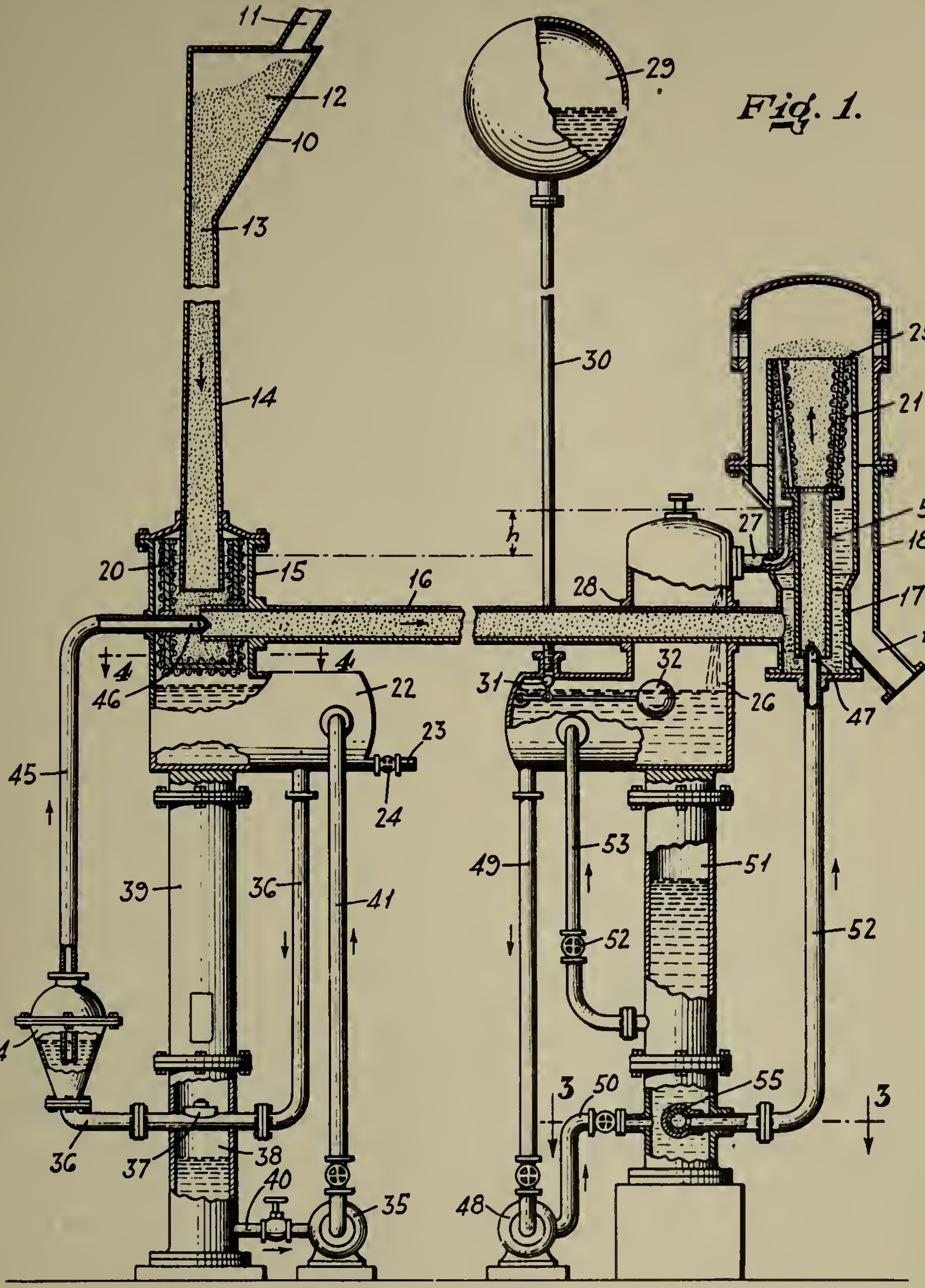
2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 2.

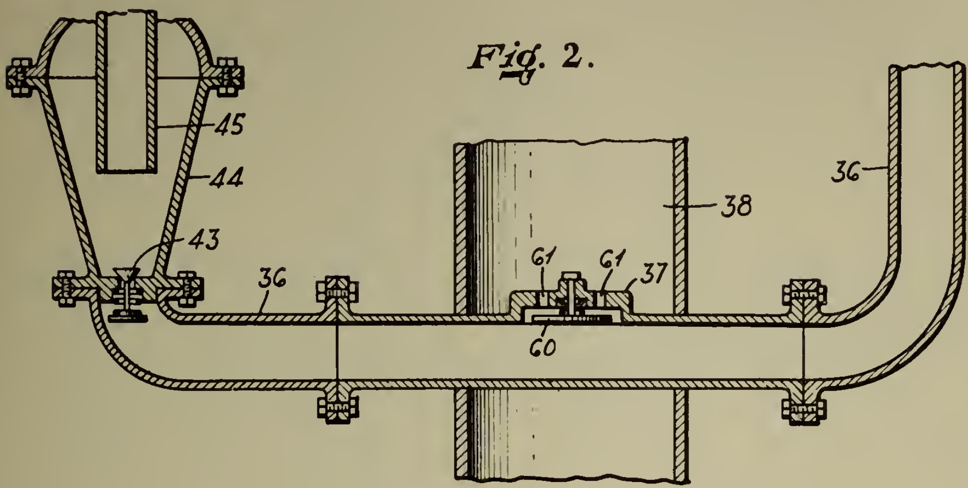


Fig. 3.

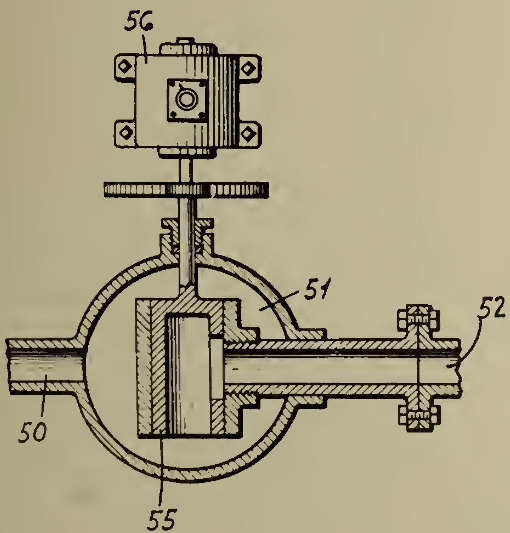
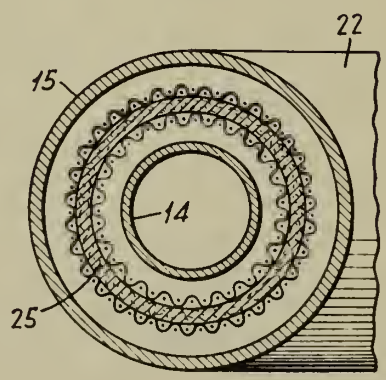


Fig. 4.



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ALIEN PROPERTY CUSTODIAN

SAFETY IGNITION DEVICES FOR GAS BURNERS

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Application filed February 27, 1939

The invention relates to a safety ignition device for gas burners in which the supply of gas to the pilot flame and main burners is controlled by a thermostat heated by the pilot flame.

In previously proposed arrangements of this kind the main gas valve and pilot flame valve have been connected with a control rod actuated by the thermostat in such a manner that on the thermostat becoming heated the main gas valve is opened and the supply of gas to the pilot flame is throttled whilst on the other hand when the thermostat cools down the main gas valve is closed and the pilot flame valve opened. In such case although the supply of gas to the main burner is shut off when the pilot flame is extinguished gas can still issue without restriction from the pilot flame nozzle. It is therefore necessary to employ a pilot flame nozzle of very small bore which entails the further inconvenience of the nozzle becoming choked by gum or the like which often occurs in the case of small bore gas nozzles. Moreover the control action of such an arrangement is considerably retarded by a pilot flame nozzle having a narrow orifice.

It is an object of the invention to provide a thermostatically controlled safety ignition device for gas burners having means for controlling the supply of gas to the pilot flame and main burner.

Another object of the invention is to provide a safety ignition device wherein the pilot flame valve and the main gas valve are opened in succession after a predetermined interval.

A further object of the invention is to provide an arrangement wherein in the event of the extinction of the pilot flame the gas supply to the main burner and to the pilot flame are cut off.

It is a still further object of the invention to provide an ignition device for a gas burner wherein a single thermally responsive device is adapted to actuate both the pilot flame valve and the main gas valve.

It is a still further object to provide a gas burner ignition device which is adapted to be set in operation by a manually operated press knob and having means whereby the gas supply to the main burner and pilot burner are thereafter automatically regulated.

Other objects of the invention will appear from the following description and appended claims when considered in connection with the accompanying drawings forming part of this specification.

According to the present invention the valves for supplying gas to the pilot flame and main burner are so arranged and combined with the control device actuated by the thermostat that when the thermostat is heated the valve for the pilot flame gas and that for the main supply open in succession after a predetermined lapse of time and are closed in reverse order when the thermostat cools down.

The result of this arrangement is that after the extinction of the pilot flame the supply of gas both to the main burner and the pilot flame is cut off. In this case the pilot flame nozzle may have a comparatively wide bore so that the troublesome choking due to gum is obviated and a rapid uninterrupted flow of gas through the pilot flame pipe accompanied by accelerated opening and therefore rapid control action of the device is obtained.

To enable the invention to be fully understood it will now be described with reference to the accompanying drawings in which five typical embodiments of the invention are illustrated. In all these embodiments substantially corresponding parts are indicated by the same reference numerals.

The safety ignition device according to Fig. 1 comprises a casing 1, with a branch 2 for connection with a gas-supply pipe and a branch 3 for connection with the main burner. Arranged on the casing 1 is a thermostat 4 composed of a bimetallic strip the free end of which is connected with a control rod 5 axially displaceable in the casing 1. Said rod 5 rests on the head 8 of a coaxially arranged thrust rod 7 adapted to slide in a valve plate 8. The plate 8 is held in the closed position by a spring 9 and is provided on its lower end with a tubular extension 11 provided with transverse bores 10 and is slidably guided on a tube 12 adapted to be axially displaced by means of a push knob 13 (against the action of a spring 14) in a guide member 15 which is screwed into the casing 1. At the same time the stroke of the tube 12 is preferably restricted by suitable means. At the end facing the knob 13 the tube 12 is fitted with a gastight packing and is provided at its upper end with an opening 16 below which is located inside the tube 11 a ball valve 17 held in the closing position by a spring 18. The ball valve 17 faces the lower end of the thrust rod 7 through the opening 16 with or without a predetermined amount of lost motion. Below the tubular extension 11 of the valve plate 8 the guide member 15 is provided with a valve seating 19 for the tube 12. The guide member 15 is provided with a horizontal bore 20 extending right through and communicating with the valve seating 19 through a widened bore 21 and with the

interior of the tube 12 through bores 22. A tube 23 leading to the pilot flame nozzle 24 also communicates with the bore 20.

The arrangement according to Fig. 1 functions in the following manner: When the various parts are set in the positions shown in Fig. 1 the arrangement is in the inoperative position. To set it in operation an upward pressure is applied to the knob 13. By this means the tube 12 is correspondingly raised from the value seating 19 so that the gas entering through the branch 2 can flow past the valve seating 19, bores 21 and 20 and the tube 23 of the pilot flame nozzle 24. Raising the tube 12 by means of the knob 13 also causes the ball valve 17 to be opened but since the tube 12 also closes the bores 10 the opening of the valve 17 is inoperative for admitting the gas to the pilot flame nozzle. Consequently the supply of gas to the pilot flame burner 24 takes place at first only by way of the valve seating 19 in the manner already described.

If the gas issuing from the nozzle 24 be now ignited the pilot flame heats the bimetallic strip 4, the free end of which then depresses the control rod 5 and therewith the thrust rod 7 which opens the ball valve 17 more fully against the action of the spring 18. After a short interval the knob 13 may be released whereupon it is returned to its original position by the spring 14. At the same time the tube 12 also is returned into its original position to seat on the valve seating 19. However, since the tube 12 has again uncovered the transverse bores 10 in the tubular extension 11 of the valve plate 8 and the thrust rod 7, correspondingly depressed by the thermostat 4 keeps the ball valve 17 open, gas is now supplied to the pilot burner nozzle 24 through the bores 10, the ball valve 17 and the bores 22 of the tube 12 and the bore 20 communicating with the tube 23 so that the pilot flame is not interrupted.

The continued heating of the thermostat 4 by the pilot flame depresses the control rod 5 still further so that the head 6 of the thrust rod 7 bears against the valve plate 8 and moves it from its seating against the action of the spring 9. In this way gas is also admitted to the main burner connected with the branch 3 and this gas is then ignited by the pilot flame in known manner.

When the valve plate 8 is depressed by the head 6 the bores 10 provided in the tubular extension 11 of the valve plate also occupy a correspondingly lower level and thus become more or less covered by the upper end of the tube 12. The supply of gas to the pilot flame nozzle 24 is thus throttled in such a manner that the pilot flame continues to burn with only just sufficient power to keep the valve plate 8 in the open position. If the gas supply to the nozzle 24 be insufficient to enable this condition to be maintained the valve opening action of the thermostat 4 will diminish and the valve plate 8 will be lifted by the spring 9. The free aperture of the bores 10 will thus increase accordingly so that the supply of gas to the pilot flame nozzle 24 is increased and the more highly heated thermostat will depress the valve plate 8 accordingly against the action of the spring 9. Consequently the supply of gas to the nozzle 24 and the main burner is regulated automatically.

If the knob 13 be held too long in the upward position the pilot flame burner 24 will receive an undiminished supply of gas owing to the tube 12 being maintained above the valve seating 19. The thermostat 4 will therefore be very strongly heated and thus exert a powerful downward pressure on the valve plate 8. The opening stroke of the plate 8, however, is limited by the tubular attachment 11, the lower end of which seats itself on a corresponding flat surface of the guide member 15 and thus interrupts the supply of gas past the valve seating 19 so that the pilot flame goes out. This arrangement prevents, therefore the thermostat 4 from becoming damaged.

If the pilot flame be extinguished and the heating of the thermostat thus ceases the free arm of the thermostat 4 returns to its original position, the valve plate 8 being returned to its original closing position by the spring 9 and the ball valve 17 similarly closed by the spring 18 so that the supply of gas is shut off from the main burner and also the pilot burner nozzle 24.

The arrangement of the transverse bores 10 for supplying gas to the pilot burner nozzle is noteworthy. These bores are comparatively wide and are arranged in such a manner as to be partially covered by the upper part of the tube 12 even when in the inoperative position. The result of this arrangement is that a sufficient aperture for the supply of gas is normally available whilst even a comparatively slight lowering of the valve plate 8 from its seat is enough to throttle the supply of gas to the nozzle 24 considerably. The possibility is also afforded of providing the pilot burner nozzle with a comparatively wide aperture which as already mentioned is of advantage in many respects.

Owing to the relatively slidable telescopic tubular members 11 and 12 for controlling the supply of gas the structural height of the entire arrangement can be kept low and the design as a whole made comparatively simple.

The arrangement according to Fig. 2 differs from that described with reference to Fig. 1 firstly in that the ball valve 17 and its closing spring 18 are located in a fixed (and not slidable) tube 25 which for example is integral with a closure member 26 adapted to be screwed into the casing 1. The free space in which the spring 18 is situated communicates with the tube 23 supplying gas to the pilot burner nozzle 24 by way of a bore 27 in the member 26 and a passage 28 in the casing 1. In this case the gas is supplied to the main burner by a branch 3 attached to the space above the valve plate 8. To make the arrangement ready for lighting up, the casing 1 is provided with a press knob 29 adapted to be depressed against the action of an interiorly housed spring (not shown). Said knob has a widened rim 30 which when the knob is depressed depresses the control rod 5 and therefore the thrust rod 7 accordingly. In this way the ball valve 16 is opened so that in contrast to the arrangement according to Fig. 1 the supply of gas to the pilot burner nozzle 24 now takes place through the bores 10, the opened ball valve 17 and passages 27 and 28. The stroke of the knob 29 is preferably restricted in such a manner that the ball valve cannot be opened to more than a slight extent so that unduly prolonged actuation of the knob will not affect the functioning of the arrangement.

When made ready for lighting up, the arrangement according to Fig. 2 functions in precisely the same manner as that according to Fig. 1.

The arrangement according to Fig. 3 corresponds with that according to Fig. 2 in so far that in this case also a press knob 29 is provided on the casing for preparing the conditions for lighting up.

According to Fig. 3 the gas is supplied through

a branch 2 arranged on the rear side of the example shown. The main burner is connected with the branch 3. The ball valve 17 and its closing spring 18 are housed in a fixed tube 31 which is integral with a diaphragm housing 32 screwed into the lower end of the casing 1. Located in the lower end of the tube 31 is a second ball valve 33 whilst similarly to the case of Fig. 2 the interior space of the tube 31 communicates with the tube 23 supplying gas to the pilot burner nozzle 24 through bores 34 in the diaphragm housing and a passage 35 in the casing 1. The housing 32 is provided with a diaphragm 36 which when in the inoperative position is pressed upwards by a spring 37 and thus keeps the ball valve 33 open by means of a pin 38 adapted to slide axially in the diaphragm housing. Beyond the main valve plate 8 the conduit supplying gas to the main burner is placed in communication with the space above the diaphragm 36 through a passage 39.

The arrangement according to Fig. 3 functions in the following manner: Making ready for lighting up is effected by means of the knob 29 in the manner already described with reference to Fig. 2 whereupon the main burner is brought into operation automatically in the manner also already described. The gas flowing to the main burner also passes through the passage 39 into the chamber above the diaphragm 36 and exerts thereon a pressure counter to that of the spring 37, the diaphragm being thus correspondingly depressed to a smaller or greater extent. The pin 34 shares the movement of the diaphragm thus more or less lifting the ball valve 33 so that under the action of the spring 18 the supply of gas to the pilot burner is correspondingly throttled by the valve 33. The resulting lowering of the pilot flame and the consequently diminished heating of the thermostat 4 adjusts the valve plate 8 in such a manner that the gas pressure in the supply pipe for the main burner is maintained at a predetermined constant level that is to say the supply of gas to the main burner is automatically controlled in accordance with the gas pressure.

Fig. 4 represents an arrangement in which the gas supply is controlled in accordance with a predetermined temperature such as room temperature. By comparison with the arrangement according to Fig. 2 that shown in Fig. 4 differs in respect of the design of the lower portion. In the case of Fig. 4 this portion comprises an attachment 40 which is screwed into the casing 1 and is integral with a tube 41 housing the ball valve 17. In this case the ball valve 17 rests on a volume control pin 42 which, when the arrangement is out of action, is lifted by the spring 18 in such a manner as to hold the ball valve 17 in the closed position. The lower end of the pin 42 is designed in such a manner that on the ball valve 17 being depressed, said pin more or less fully closes a bore 43 at the lower end of the tube 41 and thus controls the supply of gas passing in the first place through the passages 44, 45, 46 and tube 23 to the pilot-burner nozzle 24. Also branching from the tube 41 is a passage 47 to which is attached a tube 48 the other end of which communicates with the passage 45. A known instrument 49 for automatically controlling the supply of gas through the tube 48 in accordance with the room temperature is located at a suitable point in said tube 48.

The arrangement according to Fig. 4 functions in the following manner. After making ready for lighting up by depressing the knob 39 the gas supply to the pilot burner nozzle 24 proceeds by way of the bores 10, the opened ball valve 17, the tube 41 and the passages 43, 44, 45 and 46. After the thermostat 4 has become hot enough to cause the head 6 of the thrust rod 7 to move the valve plate 8 from its seating, the volume control pin is also depressed sufficiently to close the bore 43. The supply of gas to the pilot burner nozzle 24 now takes place by way of the passage 47, tube 48 and passages 45, 46. The control instrument 49 which is set to act at a predetermined temperature now controls the supply of gas to the pilot burner nozzle in known manner, the supply of gas to the main burner being thus controlled by the corresponding adjustment, already described with reference to Fig. 2, of the valve plate 8 by the thermostat 4.

The arrangement according to Fig. 5 differs in the first place from that according to Fig. 2 in that the tubular extension of the valve plate 8 is omitted so that the supply of gas to the pilot burner nozzle 24 is controlled exclusively by the ball valve 17. For this purpose the ball valve 17 and its closing spring 18 are located in a tube 50, the lower end of which is provided with a valve seating 51 and is screwed, for example, into the closure member 26. The interior space of the tube 50 communicates with the nozzle 24 in a similar way to the arrangement according to Fig. 2.

The arrangement according to Fig. 5 functions in the following manner. The arrangement is made ready as in the case of Fig. 2. If now, as the result of the thermostat becoming too strongly heated the valve plate 8 is opened wider than is desired, the ball valve 17 approaches the lower valve seating 51 in such a manner as to throttle the supply of gas to the nozzle accordingly. By this means the supply of gas to the pilot burner nozzle and to the main burner will be automatically controlled in a manner otherwise corresponding with Fig. 2.

In its manner of operating, the device for controlling the supply of gas to the pilot burner in the arrangement according to Fig. 5, corresponds with the volume control pin 42 actuated by the pilot flame valve 17 and coacting with a bore 43, according to Fig. 4. Consequently in the case also of the arrangement according to Fig. 4, the tubular extension 11 employed in connection with the main gas valve 8 for controlling the gas supply to the pilot flame could be omitted altogether.

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G. HEGWEIN

SAFETY IGNITION DEVICES FOR GAS BURNERS

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Serial No.
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Fig. 1.

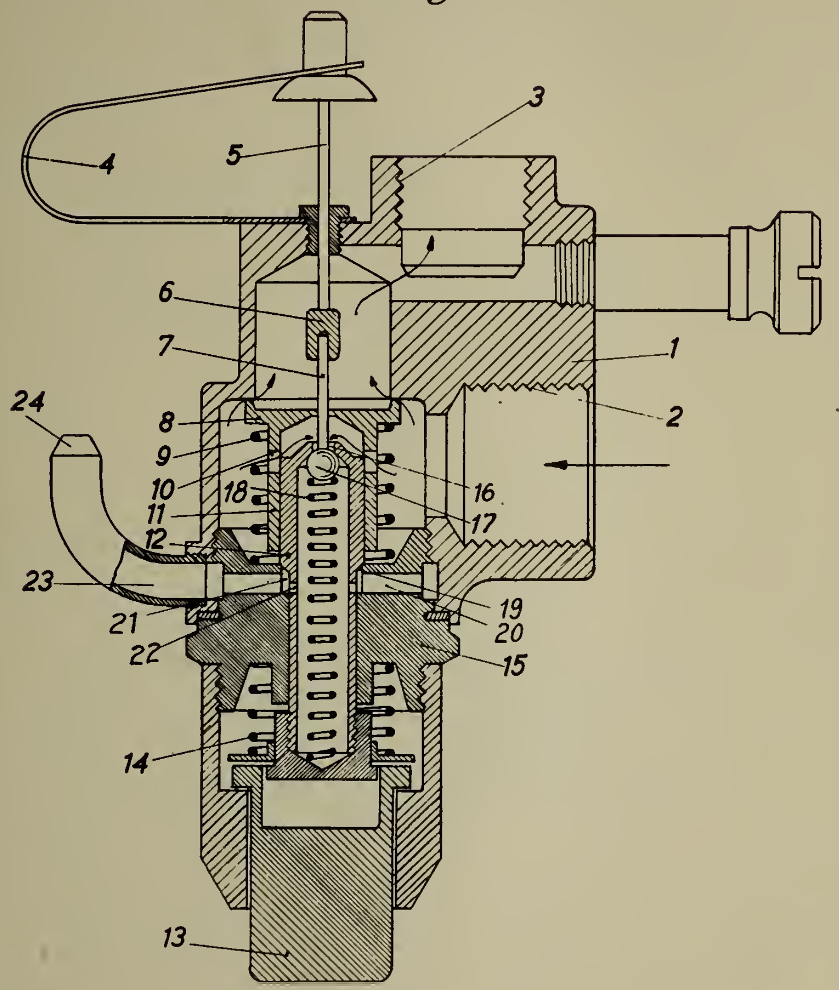

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Fig. 2.

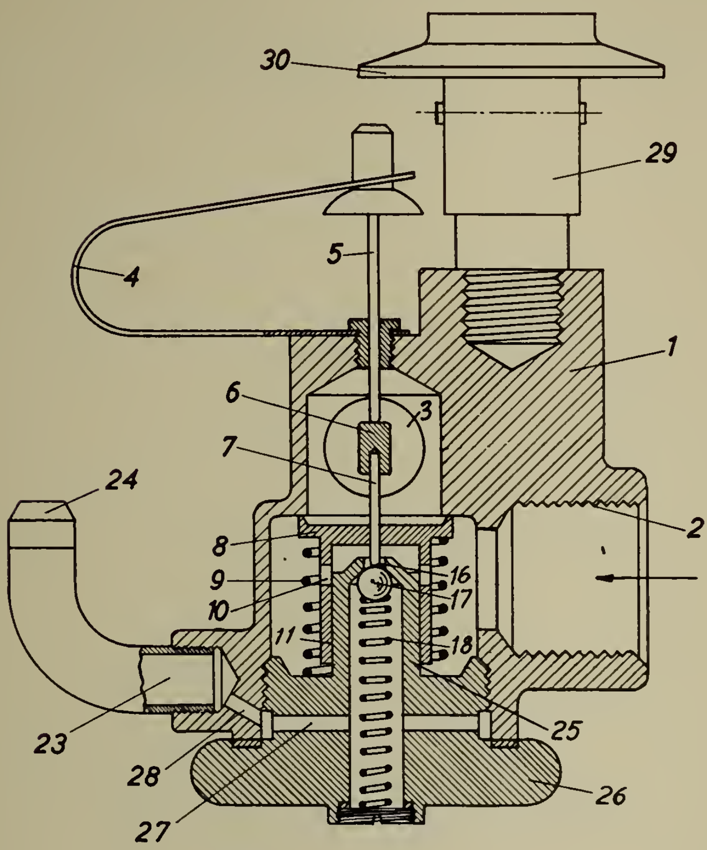

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Fig. 3.

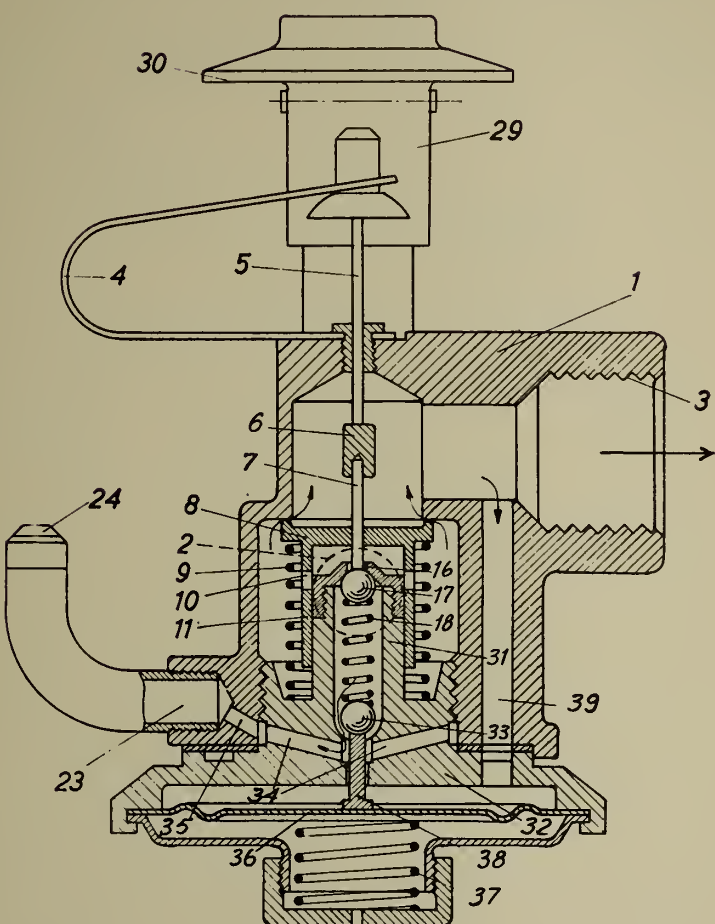

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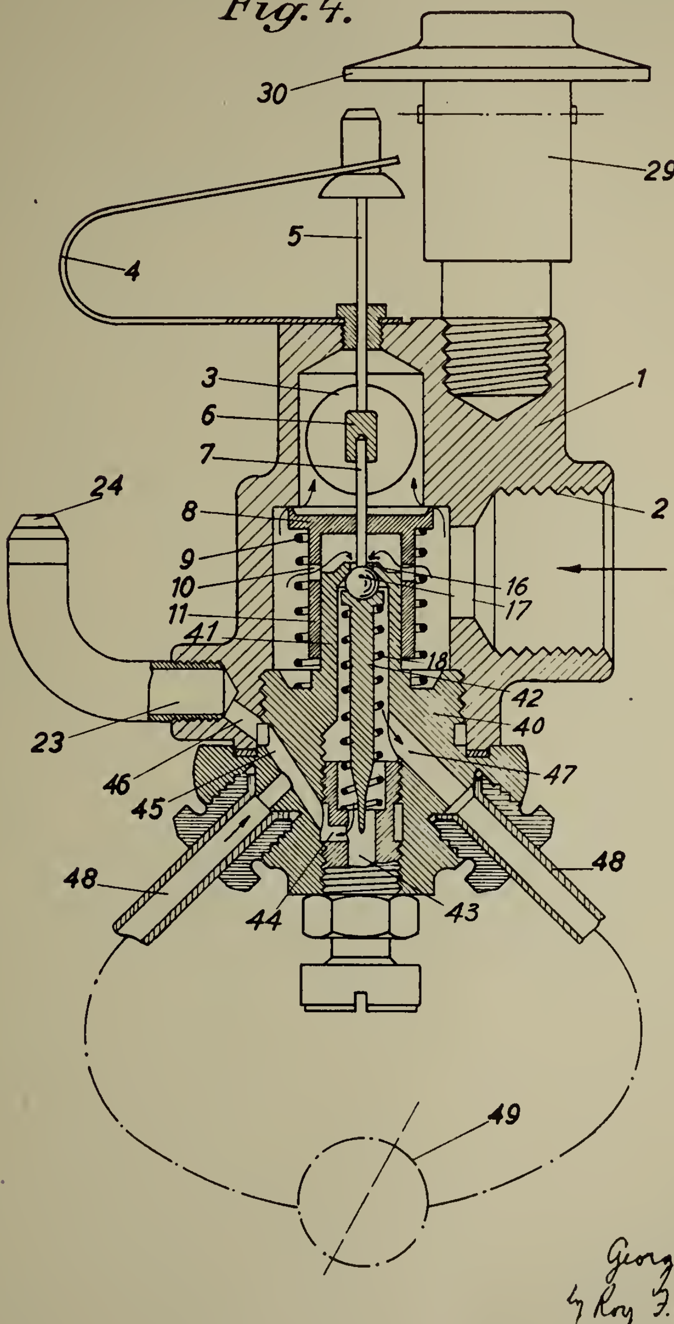
Fig. 4.



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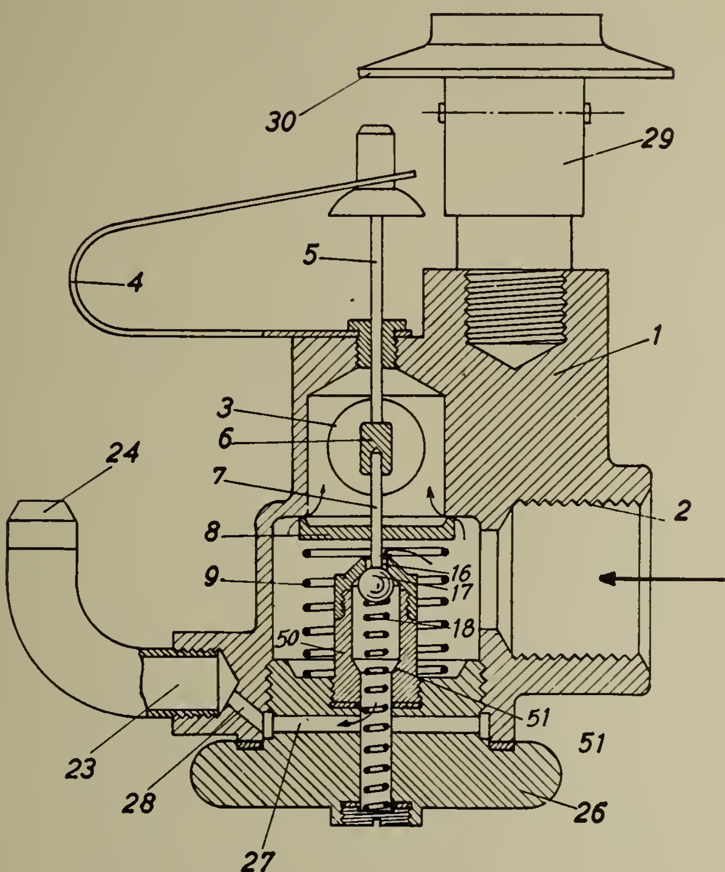
5 Sheets-Sheet 5

Fig. 5.



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ALIEN PROPERTY CUSTODIAN

SHAVING APPARATUS

Salustiano Loinaz, Biarritz, France; vested in the Alien Property Custodian

Application filed March 11, 1939

The present invention relates to apparatus, intended to be driven either electrically or mechanically, for cutting off or shaving hairs in the dry way, that is to say without making use of water, soap, or shaving creams, these apparatus being of the kind including a cutting head with one or several cutting elements constituted by an external comb including parallel and narrow teeth or knives and by an internal comb constituted by analogous teeth or knives and which is given a reciprocating movement, in contact with the internal face of the outer comb, by electrical or mechanical driving means.

There exist apparatus of this kind which include only one cutting element, of plane or curvilinear shape, and in which the teeth or knives, as well the inner teeth as the outer teeth, extend over the whole width of the cutting head, so that there is only one inlet and one outlet for the hairs. One of the chief drawbacks of apparatus of this kind is that, when the apparatus is applied against the skin, only the hairs that have penetrated between the teeth of the combs are cut off while the remainder remains bent down against the skin and can be shaved only by passing again the apparatus along the same part of the face.

In order to obviate this drawback, it has been suggested to provide the cutting head with several parallel cutting elements, located in the same plane and spaced apart from each other in such manner as to form several rows of cutting teeth with as many inlets and outlets so as to increase the efficiency of the apparatus.

However, in actual practice, it has been found that the cutting element which is the first in the direction of movement of the razor is the one which exerts the best shaving action because the skin forms a fold under the effect of the thrust of this first element and the hairs which cover this portion of the skin are caused to erect and can thus penetrate deeply between the teeth. On the contrary, the other cutting elements cannot have as efficacious a contact with the skin since the first element causes the skin to be stretched at the place where the other elements, located in the same plane, pass simultaneously.

The object of the present invention is, chiefly, to provide an apparatus of the kind above referred to which obviates the drawback above mentioned and designed in such manner that all the cutting elements can act in a satisfactory manner on the skin with the necessary pressure so that the hairs can penetrate deeply between the cutting teeth.

Another object of the present invention is to provide an apparatus of the type above mentioned with modifications and improvements capable of simplifying and improving the construction and assembly of the parts.

The essential feature of the present invention consists in making the cutting elements of a razor of the type above mentioned in such manner that they are arranged in stepped relation to one another with reference to a plane parallel to the plane along which the reciprocating movement of the movable part of the cutting head of the razor takes place.

According to another feature of the present invention, the cutting elements, arranged in stepped relation to each other and present in razors of the type above referred to, are of a width such that they are juxtaposed without interval over the whole width of the cutting head.

According to a third feature of the present invention, the inner reciprocating comb of each cutting element is constituted by an independent and removable piece, which is urged toward the external comb by separate elastic means.

According to still another feature of the present invention, the inner combs of the elements of the razors are all mounted on a common support adapted to move with a reciprocating motion under the effect of the mechanical or electical driving means of the razor, said support bearing, advantageously, on a plurality of rollers freely mounted on fixed axes.

According to still another feature of the present invention, the whole of the external combs of the razor is mounted in a removable manner on the handle of the razor through elastic clipping means freely engaged on the lateral edges of said whole and kept in position by screws housed in corresponding notches provided in the handle of the apparatus, or, more generally, fixed in any suitable manner on said handle.

Still another feature of the present invention consists in constituting the internal and/or external combs or comb of the cutting elements by means of a steel sheet suitably cut and stamped and which is given its final shape by folding it several times on itself.

According to still another feature of the present invention, the support above mentioned and in which the inner combs of the cutting elements are mounted is given a shape such that, under said combs, cavities are constituted which are capable of collecting the hairs cut by the cutting means, the bottom of said cavities carrying a small plate which prevents the hairs thus

cut off from penetrating into the part of the inside of the handle where the driving mechanism is housed.

According to still another feature of the present invention, the cavities above mentioned open freely and laterally with respect to the cutting head of the razor.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a vertical section, on the line I—I of Fig. 2, the cutting head of a razor made according to the invention;

Fig. 2 is a plan view, partly in section, corresponding to Fig. 1;

Fig. 3 is a transverse section, on the line III—III of Fig. 1, of the cutting head shown by Figs. 1 and 2;

Fig. 4 is a perspective view of a portion of an outer comb for use in connection with the razor according to the invention;

Fig. 5 is a plan view of a portion of an outer comb made according to a modification;

Fig. 6 is a perspective view of a portion of an inner comb made according to a modification of the invention;

Fig. 7 is a transverse section, on an enlarged scale, of an external comb made according to another embodiment;

Figs. 8, 9 and 10 are views, similar to Fig. 7, showing three different embodiments of external combs to be used in connection with the shaving apparatus according to the invention;

Fig. 11 is a side elevational view showing a portion of a razor of the known type the cutting head of which includes several cutting elements located all in the same plane, this view being an explanatory diagram showing the shaving apparatus in its position of utilization;

Fig. 12 is a view similar to Fig. 11, but corresponding to a shaving apparatus made according to the present invention.

The following description relates to specific examples of shaving apparatus according to the invention for cutting off and shaving hairs in the dry way, without shaving soap or cream.

The shaving apparatus according to the invention includes a cutting head, designated in a general manner by reference character 1 and an elongated handle 2, advantageously made of a molded matter, for instance Bakelite, which forms a casing in which an electric motor or any other mechanism (not visible on the drawing) is housed for driving, with a reciprocating motion, a lever 3, capable of pivoting about a fixed axis 4 and through which the drive is transmitted to the moving part of the cutting head.

The cutting head 1 is provided with several rows of parallel teeth or knives forming fixed external combs mounted in a removable manner on the handle 2 of the apparatus.

According to the invention, there are two three, or more, of these external plates, respectively designated by reference characters 5^1, 5^2, 5^3, etc., and they are arranged in such manner as to form steps with respect to a plane A—A shown in dotted lines by Figs. 7 to 10 and parallel to the plane in which takes place the reciprocating movement of the moving part of the cutting head. The stepped arrangement can be provided only in one direction (Figs. 1 to 9 inclusive) in the case of a shaving apparatus adapted to cut only in one direction, or in both directions (Fig. 10) in the case of a razor adapted to cut in two opposed directions.

The teeth of the external combs are arranged in such manner, in the embodiment corresponding to Figs. 3 and 4, as to form steps parallel to plane A—A. In the embodiments diagrammatically illustrated by Figs. 7, 8 and 9, the teeth of the external combs are arranged to form steps oblique with respect to said plane.

Said teeth may be of rectilinear outline, as in the embodiments of Figs. 3–4, 7 and 8, of rounded outline as in the embodiment of Fig. 9, or of any other suitable shape.

Furthermore, the steps formed by the combs may be so arranged as to be juxtaposed without any space between them, as in the embodiments of Figs. 3–4, 7, and 9, or to be spaced apart from one another, as in the embodiment of Fig. 8.

The rows of teeth of the combs may be arranged in such manner that said teeth are in line with one another from one row to the next one, as in the embodiment of Fig. 2, or in such manner that said teeth are in staggered relation to one another, as in the embodiment of Fig. 5.

Furthermore, the portions 5^0 of the edges of the teeth which correspond to the inlet side of each comb may be given a slightly flaring shape, so as to facilitate the penetration and erection of the hairs, as clearly shown by Fig. 4.

Advantageously, according to the present invention, the various elements of the external combs are made from a thin steel sheet which is cut, stamped, and folded on itself, forming a double fold between two successive elements, so that the whole may be constituted by a single piece which covers the whole of the area of the cutting head.

The double folds 6 formed between the teeth of two successive elements constitute rigid supports for the teeth adjacent thereto and increase the rigidity of the whole, at several points intermediate along the width of the cutting head. The latter can therefore be of smaller thickness and greater area than in the former razors of this kind and it is possible to adopt a number of steps as high as it is desired, which correspondingly increases the number of inlets and outlets for the hairs. Furthermore, as there remains, as a rule, no space between two successive steps (excepting the embodiment of Fig. 8) it is possible to take advantage of the whole width of the cutting head for a satisfactory cutting of the hairs.

When the whole constituted by the external combs is fixed in position, it is freely engaged in housings 7 provided in the upper edges of handle 2 and said whole is maintained by plates 8 applied against the lateral walls of the cutting head. For instance, these plates have each a flange 9 adapted to cover the corresponding edge of the system of external combs. They are connected to handle 2 by means of screws 10 the heads of which are housed in recesses 11 provided in said handle. These plates may be of elastic structure or they may be made of two parts connected together by spring hinges, so as to permit of easily moving them away from the handle and toward it when it is desired to remove or to fit the whole of the external combs.

This system of external combs is caused to cooperate with internal combs, such as 12^1, 12^2, 12^3 etc. which are elastically applied against the inner face of the external combs and which are given a reciprocating movement through the

medium of lever **3**, by the driving means above referred to, and in the following manner.

The inner combs, constituted by independent elements, are disposed in stepped relation to one another, and they include teeth analogous to those of the outer combs, especially concerning their shape.

Each comb element of the inner system is advantageously obtained by cutting away, stamping, and folding a thin steel sheet, in such manner as to form a piece the transverse section of which is T shaped (Figs. 3 to 6). The horizontal branch of the T corresponds to teeth **13**, which are either continuous (Fig. 2) or provided with a central reinforcing part **14** (Fig. 6). The vertical branch of the T is constituted by the folded and juxtaposed edges of the initial metal sheet. When the teeth are continuous (Fig. 2) they extend over the whole width of the inner comb and their shape is, as a rule (except in the embodiment of Fig. 9) flat.

Each inner comb element, such as $\mathbf{12}^1$, is engaged in an elastic mounting constituted by a metallic blade **15** the lateral edges $\mathbf{15}^1$ of which are bent upwardly so as to form a housing (Fig. 3) in which the vertical portion of the T is engaged. At each of its ends, each blade **15** is prolonged by an elastic finger $\mathbf{15}^2$ which rests freely upon an inner edge **16** provided in a recess **17** of a common supporting piece **18** on which all the inner combs bear through their elastic fingers $\mathbf{15}^2$. The inner combs are further maintained and guided by means of lugs **19** (Fig. 1) provided at their opposed ends and which are freely engaged, with a slight play, in notches **20** provided in the upper edges of support **18**. Thus the inner combs guided between said notches can move freely and independently in the longitudinal direction, with a small amplitude, with respect to said support, so that they can better adapt themselves against the inner faces of the corresponding outer combs. With such an arrangement, each inner comb is elastically maintained in contact, by means of independent springs $\mathbf{15}^2$, with the corresponding step of the external comb and it can follow the movement of support **18**.

I provide in the external face of support **18** a recess **21** in which is fitted the free end of oscillating lever **3**, so as to form a kind of ball and socket joint connection, whereby the support in question can be given, with the minimum of friction, a reciprocating movement through said lever. The support **18** is maintained through the medium of rollers **22** freely journalled on spindles **23** housed in a chamber **24** provided in handle **2**, said spindles being, for instance, kept in position by screws **25** the heads of which are housed in corresponding recesses of the handle.

On the bottom of cavity **17**, provided in support **18**, I fixe a small plate **26** the edges of which are prolonged as far as the walls of the chamber **24** existing in handle **2** and which prevents the hairs that are cut and collected in chamber **17** from penetrating into chamber **24** and the mechanism which serves to drive support **18**.

Close to the cutting head, the handle is provided with projections **27** adapted to prevent the skin from coming into contact with the moving pieces of the cutting head. These projections are also located near chamber **17**, in which the hairs that are cut off are collected, whereby the latter can drop freely out from said chamber through the intervals provided between these projections.

With this arrangement, I obtain an electrical or mechanical shaving apparatus for cutting off the hairs in the dry way, which apparatus complies with the conditions above referred to in that the cutting head includes several steps or rows of teeth with a corresponding number of series of inlets and outlets cleared and established at different levels. These steps or rows act all in the same manner on the skin, diagrammatically shown at **28** in Fig. 12, whereas, with prior devices, an example of which is illustrated by Fig. 11, the rows of teeth are all located in the same plane and only the front or first row acts in an efficient manner, as above explained. By means of the shaving apparatus according to the present invention, it is therefore possible to exert the desired or necessary pressure on the different portions of the skin to be shaved, in contact with the cutting head, in such manner as to compel the hairs to straighten and to engage deeply between the teeth of the combs, so as to obtain a closer shaving action.

SALUSTIANO LOINAZ.

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SHAVING APPARATUS

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3 Sheets-Sheet 1

Fig. 1.

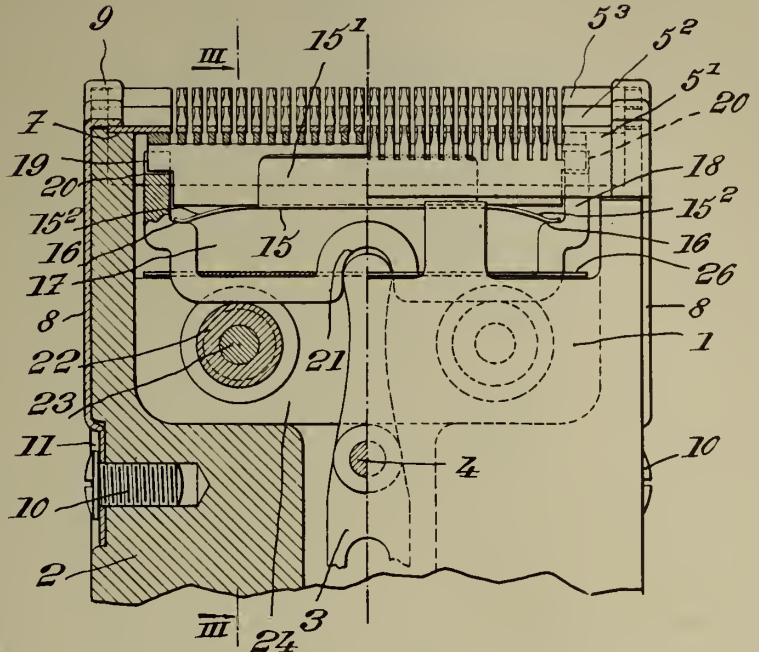
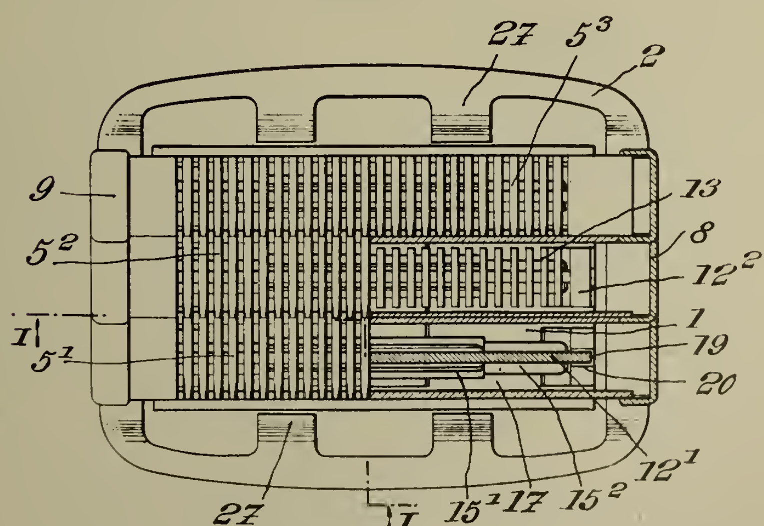


Fig. 2.



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SHAVING APPARATUS
Filed March 11, 1939

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Fig. 3.

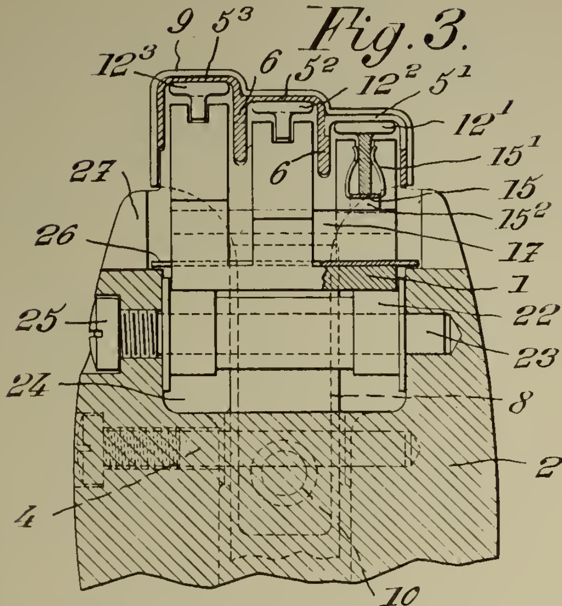

Fig. 4.

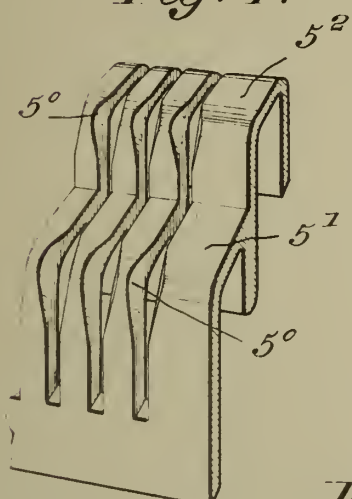

Fig. 5

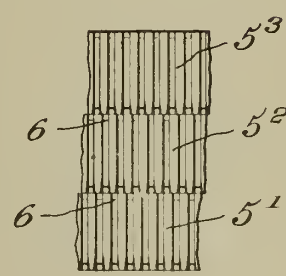

Fig. 6.

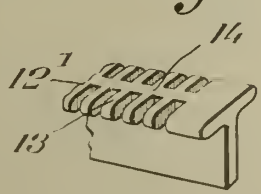

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Fig. 7.

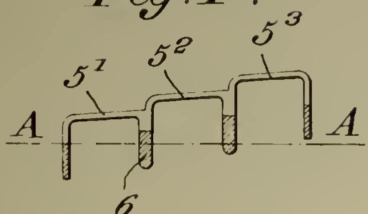


Fig. 8.

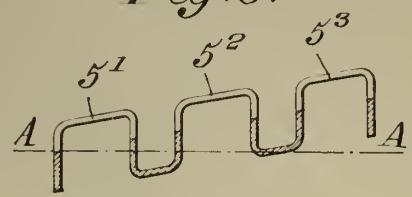


Fig. 9.

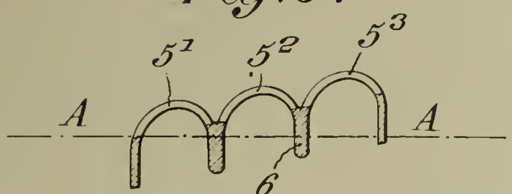


Fig. 10.

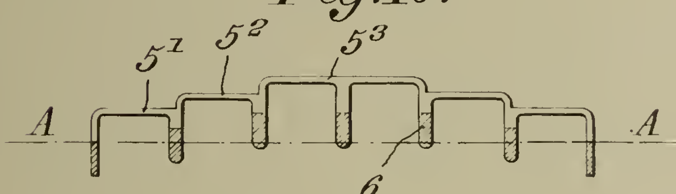


Fig. 11.

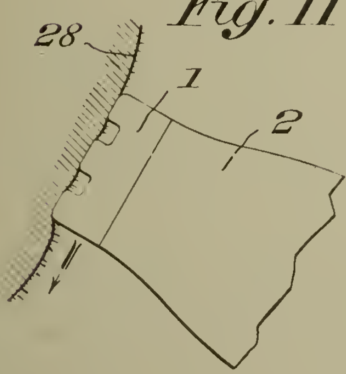
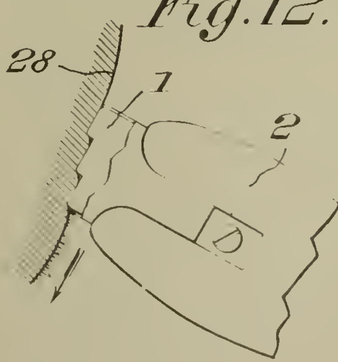


Fig. 12.



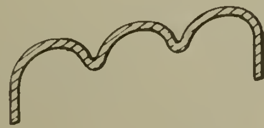


Fig. 13.

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ALIEN PROPERTY CUSTODIAN

PROCESS OF ARTIFICIAL DIGESTION OF ALBUMINOID AND FATTY SUBSTANCES

Maurice Percheron, Paris, France; vested in the Alien Property Custodian

No Drawing. Application filed March 17, 1939

The invention has for its object to repeat in an industrial manner and "in vitro" the process of the various transformations obtained by the digestion of albuminoid and fatty substances "in vivo". In other words, to divide on the one hand the peptide chains which form the various proteins, on the other hand to dissociate the nitrolipidic complexes or only the lipidic complexes and finally to bring these disintegrated elements into such a chemical and physical state that they can be readily assimilated by a living organism for subsequent regrouping.

The invention aims at effecting said disintegration by natural means, such as diastases and ferments; said invention protects the material treated and the products obtained from the bacterial actions that are capable either of producing noxious or valueless products, or of degrading the albuminoid materials until ammoniacal products and even ammonia are formed.

The invention is conceived in order:

(*a*) To obtain a biological medium which offers at the opportune instants the optimum characteristics, such as the pH or the pH1 (isoelectric point).

(*b*) To subject the albuminoids to the action of diastases or ferments, either contained in the treated materials (autolysis), or brought in from the outside (proteolysis) and thus to produce a disintegration which, at the end of the operation, has not affected the diastases or ferments or the products of poor physical or chemical stability which could not withstand acid or alkaline hydrolyses.

(*c*) To protect the albuminoids treated from the bacterial actions by acting, without in any way impairing the diastatic or fermentative actions, by conjugated means, on specific groups, this being done without resorting to the use of substances that are difficult to eliminate (sodium chloride), toxic (salts of salycilic acid, of lead, etc.), inflammable (petroleum ether, benzine), dangerous to manipulate or only slightly active on certain bacteria (homologous series of nitromethanes), denaturing (petroleum, carbon tetrachloride), etc. in spite of the more or less limited antiseptic properties of these protecting substances.

(*d*) To eliminate the protecting agents designated above either naturally during the treatment by chemical substitution or hydrolysis, or at the end of the operation by physical means such as heat and vacuum or chemical means such as precipitation in the form of readily separable insoluble substances.

(*e*) To separate the various final elements of the treatment so as to obtain isolated:

The nigrogenous compounds in the simplest form, either free, or in combinations of chemical salts, this being effected without any residue of a protecting agent;

The undigestable substances;

The lipides which accompany the albuminoids, conjointly or in complexes, and which have been able to withstand the saponifications and oxidations of the artificial digestion.

In order to obtain a suitable artificial digestion according to the aims of the invention, it is necessary:

(A) to pulp as carefully as possible the materials to be digested, so as to permit of the deepest action on the proteins both of the temporary protecting agents and of the diastatic and catalytic agents. If the diastases that are relied on for the digestion come from secretion glands added to hte mass, liver, stomach, intestine, said glands must also be very finely ground.

(B) the purpose of the following operation is to introduce the temporary protecting agents, each corresponding to quite specific actions, and also substances capable of effecting, at the desired instant, the transformation of all or part of said agents in inactive and non-toxic products. Said substances may advantageously be the following:

(1) A solution of a polysulphide of magnesium in a mixture of equal parts of acetone, isopropyl alcohol and phenylhydrazine hydrate:

(2) Jointly a mixture of three substances: chloroform, dinitrophenol and an auto-oxidizer such as a terpene pinene, for example betapinene.

Without going into the detail of very complex slow chemical reactions, it may be noted that the invention aims at using the above mentioned substances for the following purposes:

The sulphur-magnesium complex, in the presence of the albuminoids, will become stabilized in the colloidal form, will act its elective properties on the halogens, the hydroxyls and all the electro-negative radicals, and will finally become decomposed during the operation: the magnesium will tend to produce insoluble ammonium magnesium compounds; the sulphur will combine to form halo-organic salts with certain cyclic amino acids when they appear or will effect substitutions of sulfonated form with the phenol nucleus of one of the other agents.

In the presence of the colloidal sulphur, of the chloroform (or of a substance of the harmonic series of same) and of the pinene, there will be

formed, by substitution, oxidation or displacement, monosulfonic orthophenol, nascent chloromethane (or chloroethane or again parachlorodinitrephenol) and finally, by bonded oxidation of the pinene, paraphthalic acid (or a monochloro derivative of same). It would moreover be advantageous to associate the dinitrophenol with a sulfonic acid chloride so as subsequently to sulfonate the phenol nucleus more surely.

These substances, which are powerfully antiseptic in small doses (less than 4 per 1000 of the mass to be treated), possess the property of forming slowly and then of dissociating slowly by hydrolysis in an acid medium, precisely when at a given instant the pH of the treated mass spontaneously reaches 6.4, ionic acidity due to the nature of the amico-acids then formed.

They can be replaced by vicinal substances of the harmonic series, without the principle of the invention being modified thereby: for example, nitro-methane may be substituted for the chloroform, camphrene for the betapinene, diphenylaminosulfone or metaphenylenediamine for the dinitrophenol, etc. In any case, the substitution substances obtained by reaction are comparable in nature and in effect, and the chlorinated residues as well as the NO_2 radicals that may persist are fixed on the lipides whence they can be readily extracted by heating to 80° C. None of the above referred to agents offers any opposing action to the reaction of metallic catalytic agents that it might be considered advisable to employ in order to accelerate the artificial digestion.

It must furthermore be noted that betapinene or any other strongly auto-oxidizing agent is employed in order to act, by bonded oxidation, on the arginine (one of the first amino-acids released from the peptide chain) so as to prevent the formation of free guanine. It is moreover advantageous to use it in a methylated or methylic form, so as to assist the formation of insoluble methylguanidine. This substance also acts tine the subsequent formation of the peroxiacids produced by the desintegration of glycerines of unsaturated fatty acids.

(C) A very thorough stirring by means of appropriate apparatus is effected in order to mix first of all the previously described solution of polysulphide of magnesium, then the chloroform-pinene-dinitrophenol mixture. The mass thus treated can be kept and stored indefinitely: there is therefore in this part of the invention a means for protecting from bacterial actions all perishable materials which can previously withstand a state of fine division.

(D) But a mass thus treated may not under certain conditions, be protected from aerobic bacteria, mildew, spores, etc. which are capable of developing and of producing secondary fermentations. Protection therefrom is obtained by covering the mass stored in a tank with a fine layer of oil in which p-hydroxybenzoic acid has been dissolved (in the hot state) to form a $\frac{1}{2000}$ solution. A larger quantity of this 1 per 2 mil oily solution carefully mixed with the mass to be treated will prevent the oxidization of the unsaturated fatty acid lipides, at any rate in the cold state and for a limited time.

(E) Before placing the mass to be digested in the maturation tanks, it is necessary to bring it to the suitable pH for starting the diastatic reactions. Said pH varies of course according to the material: fish, meat of herbivorous animals, ovalbumin, flesh or organs of carnivorous animals and even leguminous materials. But the concentration is always less than pH7 and the optimum point is obtained by slight acification of the mass.

This operation is effected at the same time as the mixing with the protecting substances hereinbefore defined, in the case of an immediate digestion. On the contrary, in the case of storing, it is only effected at the time when the mass is placed in the maturation tank, by means of a second mixing since it would start a slow lysis in the cold state of the mass during storage.

(F) The mass of proteins and diastases thus prepared is then placed to digest in a maturation tank of any content. The temperature is such that the nitrogenous disintegration takes place as quickly as possible, without however there being a coagulation of the free albumins and a destruction of the diastases or ferments. The bringing to the required temperature should be effected quickly: it is therefore necessary to act on a divided mass which is stirred continuously or not, avoiding local overheating and the formation of crust.

The pH falls gradually to 6.4 then rises towards 6.8. When it reaches this approximate value and stays there, bussering is effected with soda until the pH1 is obtained: the basic function of the amino-acids (which are amphoteric) will thus act freely and salts of said amino-acids will thus form, for example histidine sulphate.

(G) The digestion is stopped when the pH has returned of its own accord to pH6.8 and stays so for twenty four hours. The total duration of digestion varies according to the nature of the substances to be treated, to the temperature, to the nature and the importance of the diastases.

(H) The pasty mass which has been placed to digest appears at the end of the operation in the form of a liquid in which an undigested layer has sedimented. The liquid part is formed by an aqueous solution of polypeptides and of amino-acids (or of salts), of free lipides and of peroxidized lipides in suspension or of saponified materials. These various substances are separated by decantation, defecation with tanin and with lime, centrifugation, filtration and ultracentrifugation, its being possible for these mechanical processes to be combined, used in the hot or the cold state, according to whether it is desired to isolate in such and such a part soluble substances above a given temperature.

Finally there is obtained:

(*a*) Undigestible substances: cartilage, conjunctive substances, bones, fish-bones, scales, etc, according to the substances treated;

(*b*) Nitrogenous products in aqueous solution; these products no longer exhibit any trace of the temporary protecting agents; it is therefore necessary to concentrate them since otherwise various bacterial actions may occur. As the liquid keeps indefinitely as soon as it is deprived of 50% of its constitutive water, the excess of water may advantageously be removed either in vacuo, or by streaming, or by exposing in a thin layer, or by cryogeny or adsorption or by any method which neither causes a decarboxilation nor a deamination but which on the other hand removes certain ammoniacal products. This concentration may be continued until the pasty or even the dry state is reached; the amino-acids or their salts then appear in a crystalline form;

(*c*) Fatty degrases remaining on the filter or separated by decantation or centrigugation. These degrases represent in reality a unidigested mixture, chromoproteins, peroxides of fatty acids

and of various lipides, salts of various phosphoric acids, amino-alcohols, lecitins, higher alcohols, often with fixation of chlorinated residues or of nitrile radicals.

(I) After replacing said degrases to digest in order to finally eliminate the undigested materials which has been stopped at the digestion ceiling during the first maturation, the various products are exposed as a thin layer either to a vacuum or to a suitable heat respecting the organoleptic diastases so as to eliminate the volatile chlorinated residues.

From these fresh exhausted degrases, is separated the excess of free lipides by decantation, pressure or centrifugation. Then the residual mass is treated with suitable solvents in such a manner as only to carry away the fatty substances. The products which might be dissolved, other than the lipides, will in this case be precipitated in the solvents. Finally, a heterogeneous mass of phosphoaminated substances will be obtained: that can, if necessary be readily separated by the usual washing, fractionated solubility and chemical precipitation means.

Finally, by operating according to the described phases of this invention, a slow but absolutely complete artificial digestion has been obtained, which is certainly carried much farther than in the natural operations of living organisms: The complex protein molecules have been extremely divided (chief object of the operation); a part of the lipides has also been converted into elementary substances. The whole of the products obtained, save the undigestible substances, represent elements that are particularly assimilable by a living organism, that have a high nutritive power and a high therapeutical value.

Food products are thus obtained which, save for the wilful separation or elimination of at least one half of the radicals hereinbefore defined, contain all the amino-acids produced by the lysis of the treaded materials. These products offer the feature of being able, save for wilful separation, to contain the whole gammut of the radicals which initially existed in the proteins of animal or vegetable origin subjected to disintegration, but said radicals, instead of forming part of complex organic chains, are in the free state in the form of amino-acids or combined in the form of salts of these latter.

It should be noted, on the other hand, that these finished products are stable although they contain neither sodium chloride nor any other preserving agent.

Preferably, the products are so treated as to be in the form of a medium that is unsuitable for sowing, so as not to be capable of uncontrolled subsequent transformations.

MAURICE PERCHERON.

Published June 1, 1943

Serial No. 263,038

ALIEN PROPERTY CUSTODIAN

APPARATUS FOR STORING AND CONVEYING CARD INDEXES OR OTHER SUITABLE ARTICLES IN CONTAINERS OR THE LIKE

Otto Alfred Becker, Saarbrucken, Germany; vested in the Alien Property Custodian

Application filed March 20, 1939

This invention relates to a modification of the apparatus described in the specification of my application for patent in the U. S. A. No. 151,059 in which a different combination of the same mechanical means is employed and which enable the object to be attained in a simple manner. While in the apparatus described in the specification of the patent application Ser. No. 151,059 the superposed containers are moved successively in circulation along a rectangular path so that all containers which are above the selected container must be shifted laterally, the loose containers are, according to the present invention, raised by a conveying mechanism in a box common for all containers above the top of a table to a height, according to the adjustment of a selecting device, so that the desired container can be removed from the pile of containers and brought to the working place by another conveying mechanism. The selected container brought to the height of the desk top may be pulled out of its compartment by hand if the working place is sufficiently near the container box. But, according to the invention, a conveying device may be provided which allows the working place to be at any desired distance from the pile of containers and several working places to be connected with the same pile of containers. Conveying apparatus are known in which container boxes are raised and lowered as in an elevator. The known constructions are not perfect and fail to fully fulfill their object.

The selection in these known apparatus is effected with the aid of the eyes and a corresponding concentration on the selecting operation. This results in a continually recurring distraction from the actual work to be done, for example the entry of a booking. The invention hereinafter described has for its object to completely relieve the operator from the selecting work and entrusts this to the machine. Thus, selecting and setting devices (which are described in my above mentioned application) cooperate with switching devices which reverse the poles of the driving motor in the direction of the shortest path for the container to reach the working level, and suitable conveying mechanisms for conveying the desired container to the place of work cooperate with a vertically operating conveying mechanism to produce a novel complete total effect. Without such mechanisms it is necessary in the known apparatus for the operator to use his hands and eyes, resulting necessarily in a restriction of the speed. Apart from the unsatisfactory degree of efficiency, the continually recurring diversion from the actual work by searching for the desired container is also an important point. The invention which will be hereinafter described relieves the operator not only from the tiring repeated diversion, but at the same time enables him to use this time for carrying out his actual work to which he can give his whole attention.

The known apparatus are not suitable to be placed in the middle of a room as desks, because they require a real elevator shaft above the pile of containers. This objection is overcome by the solution of the problem hereinafter described, according to which the container boxes are gripped at the bottom or sides without parts of the mechanism being arranged above the place of work or project above the container boxes.

Two embodiments of the invention are illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is a longitudinal section through a desk with two container boxes of which that on the right is in raised position,

Fig. 2 is a horizontal section of Fig. 1,

Fig. 3 is a top plan view, the desk top being removed,

Fig. 4 shows a container ejector in vertical section,

Fig. 5 shows in cross-section the pole reversing device and selecting and setting device,

Fig. 6 is a top plan view of Fig. 5,

Fig. 7 is a perspective view of a modified form of construction.

The containers **1** with the piles of card index cards are accommodated in a common vertically shiftable container box **3** or the like. The containers are arranged closely spaced one above the other and carried by supporting and guiding bars **2** on the side walls of the container box **3**. The container box is moved up and down by screw spindles **6** meshing with racks **5** on the container box. Some of the screw spindles have right hand threads while the others have left hand threads. The box **3** is guided not only by the screw spindles **6** but also by guide members **4** at the corners of the box. The screw spindles **6** are driven by a motor **7** through the intermediary of a toothed wheel gearing **8** or **9**, Figs. 1 and 2. An electro-magnetic clutch **10** is provided for alternately actuating container boxes at opposite sides of the desk, which clutch drives now the gearing **8** and then the gearing **9**.

For taking up part of the weight of the container boxes two helical springs **14** (Fig. 4) are provided for each box and connected to an at-

tachment member 11 (Fig. 2) by ropes 12 (Fig. 3) guided by rope pulleys 13.

The container box 3, when in motion, is brought to a standstill by a magnet brake 25 as soon as the container 1 selected by means of a setting device 27 hereinafter described, has reached the level of the desk top 23 (working place). The magnet brake 25 not only stops the conveying mechanism but also switches off the motor 7 and switches on an electro-magnetically operated spring-loaded ram 17, 18 (Fig. 4) and a motor 22 which drives another conveying mechanism consisting of chains 19, sprocket wheels 20 and catches 21 (Fig. 3).

The catches 21 engage in corresponding projections of the container 1 and convey the selected container out of the box 3 on to the place of work. When the container reaches the prescribed extreme position on the place of work, a contact 24 is actuated by the catch and this conveying mechanism is also brought to a standstill. For conveying the selected container back into its box a press button contact (not shown on the drawings) is provided which causes the conveying mechanism to convey the container in the opposite direction and slide it into its box 3.

As above mentioned the selection of a certain container 1 from those in the container box 3 is effected by the adjustment of a setting device 27 which cooperates with a selecting device 31 and with a magnet brake 25. An example of such a setting device is illustrated in Figs. 5 and 6 and this device comprises an endless setting band 43 guided by rollers 44*a* and 44*b* of which the front roller 44*b* can be driven by a knurled knob 42 with a flywheel 45 and bevel wheels 41. The setting band 43 has on its right hand half markings indicating the containers in the right container box and on the left hand half similar markings indicating the containers in the left container box the markings being in the same sequence as the containers are arranged in the boxes. If the operator turns the knurled knob 42, the individual markings appear successively under a window 52 and consequently the band can be set to the marking indicating the container required. Corresponding to this setting movement of the setting band spindles 38 and 38*a* are at the same time driven by the turning of the knurled knob 42, through the intermediary of the bevel wheels 41 which drive a shaft 40 connected to the spindles 38, 38*a* by worm gears 39, 39*a*. These two spindles 38, 38*a* carry a common bar 28 whose ends are constructed as nuts by which the lever 28 is moved to and fro by the spindles 38, 38*a*. The bar 28 has on its left end a contact 28*c* which slides along a contact bar 55 connected to the positive pole of a source of current. Two slides 29, 29*a* of insulating material are arranged under the bar 28 and adapted to be moved to and fro by two separately operated spindles 35 and 35*a* engaging nuts 34, 34*a* on the slides, in accordance with the actual movement of one of the container boxes. For this purpose the spindles 35, 35*a* are connected each to one of the toothed wheel gearings 8 and 9 by worm gears 36 and 36*a* and flexible shafts 37 and 37*a* respectively. The left slide is connected for example to the left conveying mechanism of the left pile of containers and carries out all movements of this pile but on a smaller scale, whereas the right slide is connected to the right conveying mechanism. The slides 29 and 29*a* have contacts 31 and 31*a* respectively which slide along contact bars 53 and 53*a* respectively and can thus be brought into connection with the negative pole of the source of current. The bar 28 has near its ends contact projections 28*e* and 28*a* which can be brought into contact with the contacts 31 and 31*a*. The bar 28 can be moved to and fro by the setting device only along a predetermined path A—B. The setting points for all the containers are arranged successively on this path. The bar 28 is brought into predetermined position by the setting of the band which corresponds to the actual working on the band 43. Every movement of a container box results in a movement of one of the slides and consequently of one of the contacts 31 and 31*a* towards the selection bar 28. When the selected container 1 has been brought to the level of the desk by the movement of the container box 3, its associated slide contact 31 or 31*a* has travelled up to the actual position of the selector bar 28. This is due to the fact that the total adjustment path A—B for the adjustment of all containers 1 in a box 3 is of the same length as the total path along which the slide 29 or 29*a* moves, when its associated container box moves from its lowest into its highest position. When the container set in the selecting and setting device is at the height of the desk top the contact 28*e* or 28*a* on bar 28 and the contact of the corresponding slide 31 or 31*a* make contact. By this contact making the magnet brake 25 is actuated so that the selected container is brought to a standstill at the level of the table top, the motor 7 is switched off and the auxiliary motor 22 switched on.

It is pointed out that as long as the setting device is being adjusted the current is switched off and is only switched on by the actuating of one of two press buttons or switches after the adjustment has been made and contact is made between the bar 28 and one of the slide contacts 31, 31*a*. One press button is provided for the right container box and one for the left container box. When one of these buttons is pressed the corresponding magnetic coupling with one or other of the counter shafts 8, 9 takes place.

The slides have, however, another duty to perform. As the motor must move a container box up or down as may be required, it is necessary to effect a pole reversal to change the direction of rotation of the motor when required. This pole reversal takes place automatically by means of the slides 29, 29*a* which for this purpose have contact strips 30, 30*a* and 30*b*, 30*c* respectively. The contact strips are of similar size and insulated from one another in the longitudinal direction by separation, so that each slide has an upper contact strip 30*b*, 30*c* and a lower contact strip 30, 30*a* respectively. At the movement of a container box 3, the upper contact strip 30*b* or 30*c* moves down with the slide 29 or 29*a* and, when the container box 3 reaches its highest position, assumes the position originally occupied by the lower contact strip 30 or 30*a*. This is the lowest position which the upper contact strip can assume. The upper and lower contact strips of each slide are in permanent contact with a stationary conductor bar. Two upper conductor bars 32*b*, 32*c* are provided for the two upper contact strips and these bars are connected in such circuits that the motor 22 at the closing of a circuit rotates in that direction which effects a downward movement of the raised container box. If the container box is in its lowest position in the desk, the corresponding slide 29, 29*a* is in its

highest position so that the upper contact strips **30***b* and **30***c* are outside the selecting path A—B of the selector bar **28**. In this position none of the containers can move downwards but all can move only upwards (Fig. 6). This is effected by the lower contact strips and the corresponding lower stationary conductor bars **32**, **32***a*. When the container box **3** is in its highest position the corresponding slides are in their lowest position, and consequently the lower contact strips are below and outside the selecting path A—B of the selector bar **28**. No contact making can take place which could cause the motor to effect a further upward movement of the container box. The same applies for the intermediate positions.

The contact making is effected by the contact projections **28***b* and **28***d* on the selector bar. These projections slide on the contact strips **30**, **30***a* and **30***b*, **30***c* respectively. According to literature a contact making only takes place on one of the lower contact strips **30**, **30***a* or on one of the upper contact strips **30***b*, **30***c*, the positive current is conducted from bar **55** through the selector bar **28** to the one or other of the terminals of the motor by the bars **32**, **32***a* or **32***b*, **32***c*, that is the motor in this manner changes its direction of rotation. The direction in which the motor rotates is determined by the actual position which the slides **29** or **29***a* assume by the conveying mechanism corresponding to the position of a container box, and by the adjustment by means of the selector bar **28** to the container actually required.

The switching device, by means of which the pole reversal actually required or the direction in which the motor is to rotate, is determined, serves only for switching the motor into the circuit for the direction of rotation actually required. The current after the switching on, for example by means of a relay, no longer flows through the switching device but through one of the main circuits. The switching device moves, so to speak, in the opposite direction to the pile of containers; if this moves upwards, the slide moves downwards. Owing to this counter movement the contact connection with the lower contact bars is interrupted and the contact connection established with the upper current bars for all containers which have been raised above the level of the desk top, so as to enable at any time a return to the level of the desk top by reversal of movement. When the circuit of the driving motor has been closed, the movement of the motor is independent of the continued movement of the switch path until a standstill is reached.

The selecting and setting device and the pole reversing device are mounted in a frame **46**, **47**, **48**, **49**, **50**, **51**.

It is also pointed out that at the ends of the spindles **6** pressure contacts (not shown) are arranged which switch off the driving motor as soon as the container boxes assume their uppermost or lowermost positions. A similar interrupter contact is arranged directly in front of the point where the containers are pushed out of and into the boxes so that, if a container is not pushed sufficiently far into its box, operation of the motor is prevented by the pressure exerted on this contact point. To securely hold the containers in the container boxes suitable engaging snaps are provided. It is also advantageous to arrange the conveying mechanism for the lateral displacement under the desk top and to establish connection with the containers by narrow slots through which catches **21** move or engage in suitable projections on the containers. To enable the containers to be pushed reliably into a box without damaging the cards, it is advisable to provide a cover on the side when the containers are pushed into the box.

Finally it is pointed out, that this conveying mechanism and also the conveying mechanism described in the specification of the main patent application is suitable for combining with other machines such as typewriters, calculating, booking, sorting, multiplying, tabulating, perforating and printing machines and the like. In this instance only simple connecting conveying mechanisms, such as conveyor bands, pressure cylinders, rollers, grippers, carriers, pushing devices, lifting mechanisms, piling devices and the like are required according to the character of the different combinations.

Fig. 7 shows in perspective view a somewhat modified form of construction, in which the elements above described are also used. The container box is arranged opposite the place of work instead of laterally thereof. It consequently allows, in the case of card indexes, an arrangement of the cards so that they can be turned over like the leaves of a book. It is evident that, besides this arrangement, container boxes may also be arranged in the side portions of the desk and actuated by a common selecting and setting mechanism and switching device.

OTTO ALFRED BECKER.

PUBLISHED

JUNE 1, 1943.

BY A. P. C.

O. A. BECKER

APPARATUS FOR STORING AND CONVEYING CARD INDEXES OR OTHER SUITABLE ARTICLES IN CONTAINERS OR THE LIKE

Filed March 20, 1939

Serial No. 263,038

4 Sheets-Sheet 1

Fig. 1

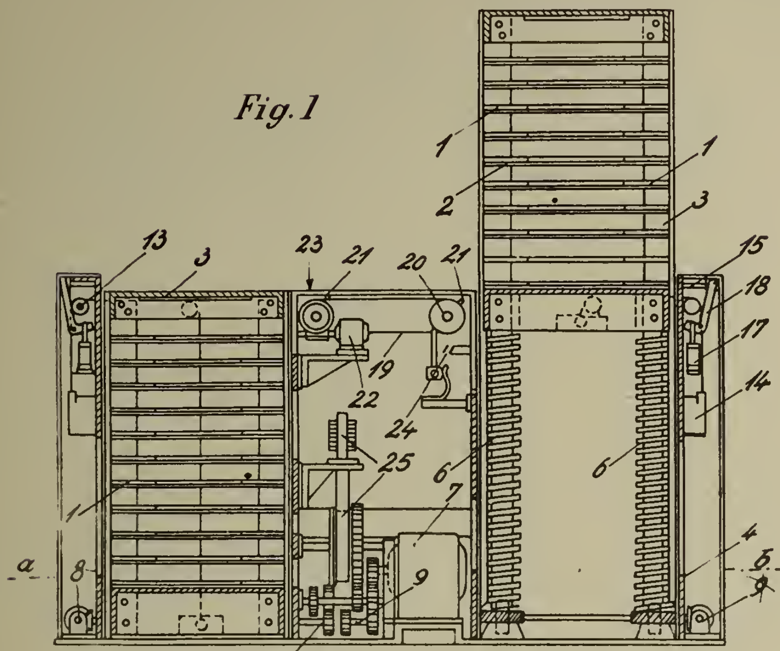
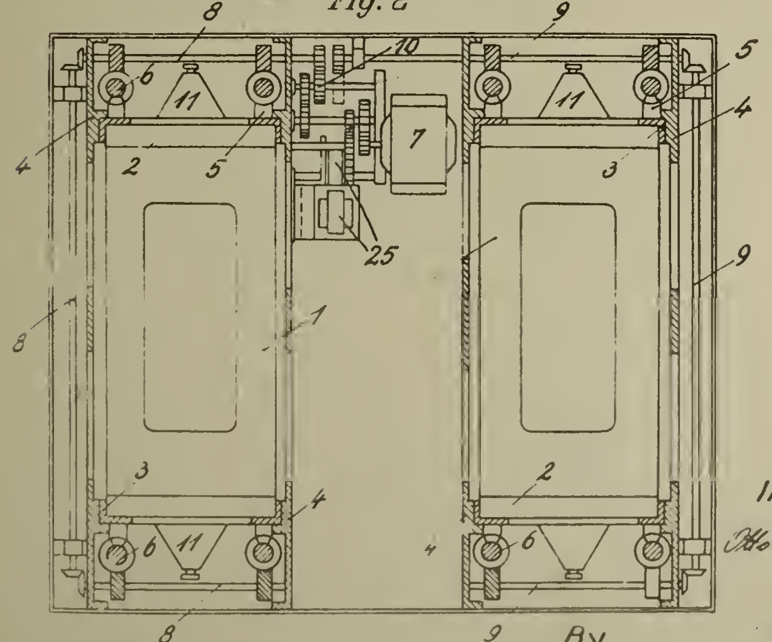


Fig. 2



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Serial No. 263,038
4 Sheets-Sheet 2

Fig. 3

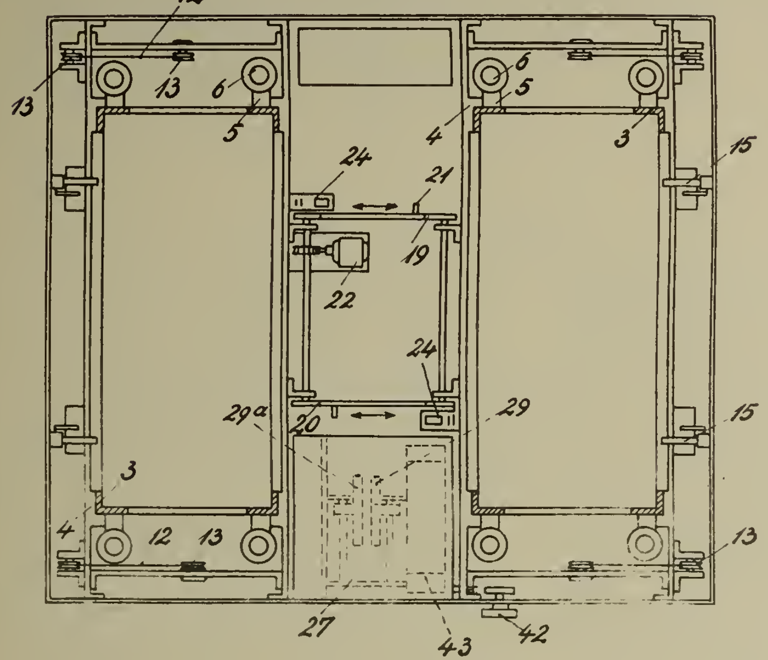
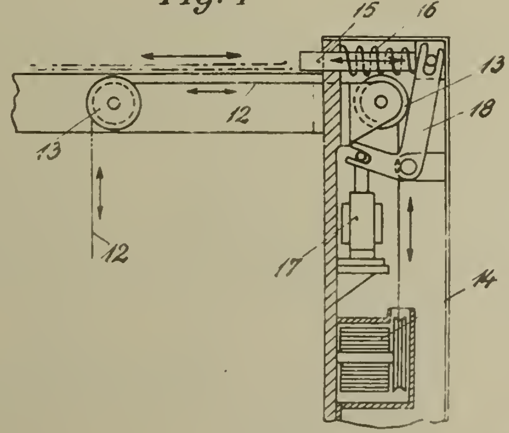


Fig. 4



Inventor

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O. A. BECKER
APPARATUS FOR STORING AND CONVEYING CARD INDEXES OR OTHER SUITABLE ARTICLES IN CONTAINERS OR THE LIKE
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263,038
4 Sheets-Sheet 3

Fig. 5

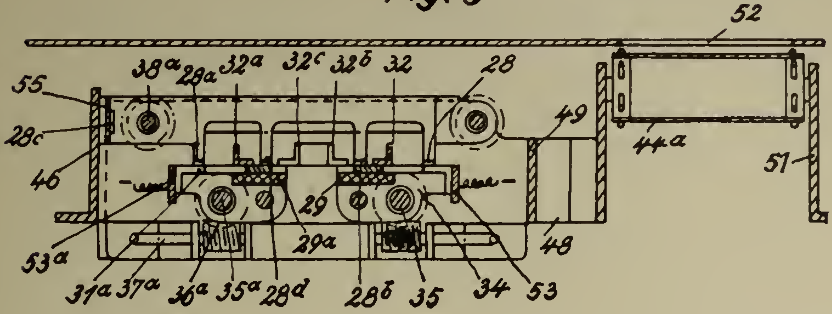
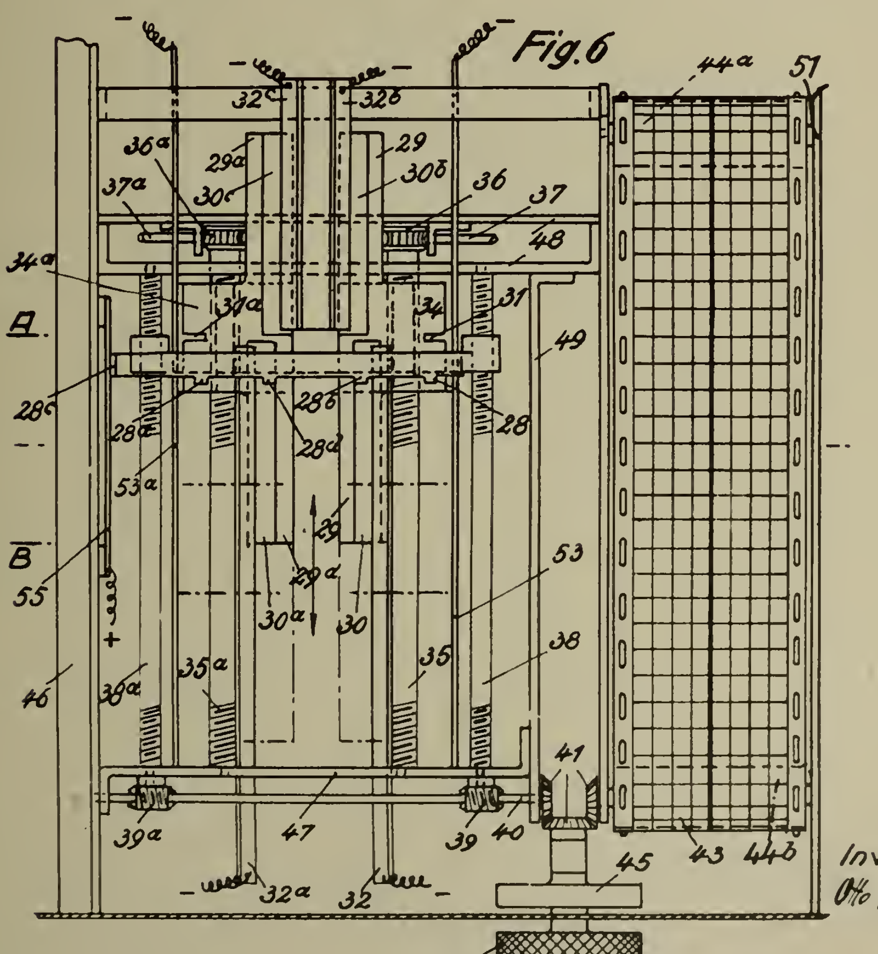


Fig. 6



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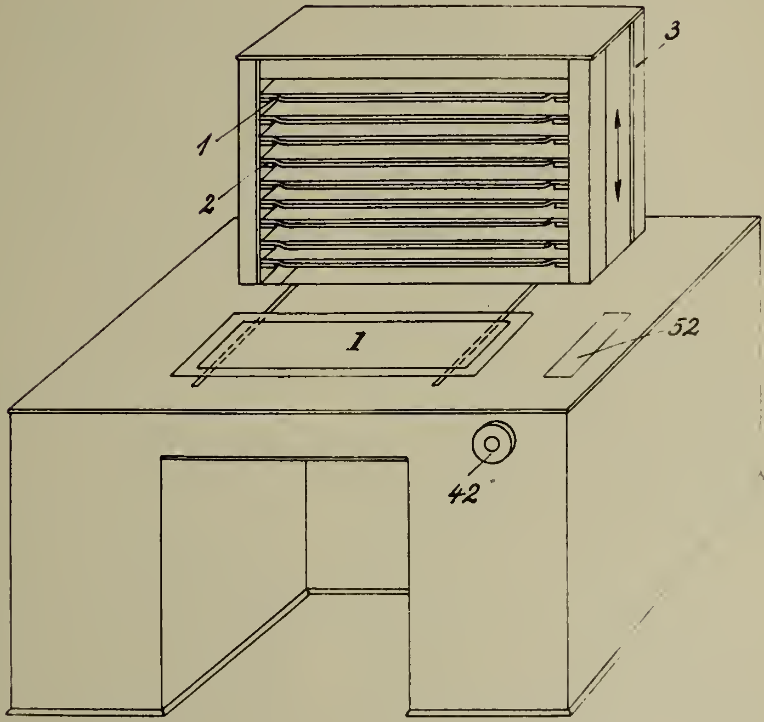
4 Sheets-Sheet 4

Fig. 7



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Published June 1, 1943 **Serial No. 270,158**

ALIEN PROPERTY CUSTODIAN

HIGHLY REFRACTORY MORTARS, TAMPING MATERIAL AND MATERIALS FOR REPAIRS AND COATING AND A PROCESS OF AND CEMENT POWDERS FOR PREPARING THEM

Karl Dietz, Cronberg (Taunus), and Heinrich van Thiel, Berlin, Germany; vested in the Alien Property Custodian

No Drawing. Application filed April 26, 1939

The present invention relates to highly refractory mortars, tamping material and materials for repairs and coating and a process of and cement powders for preparing them.

For the manufacture of highly refractory mortars, tamping material and materials for repairs there are chiefly used substances which as regards their main properties resemble the basic material of the fire-bricks to be used in masonry. Moreover, for the protection of fire bricks there are often used refractory coating materials consisting of the same substances as the fire bricks, or refractory coating materials containing particularly highly refractory substances which cannot be used in making the whole building unit owing to their high cost. The highly refractory materials for the purpose in question are in most cases made up with clay as a binding agent, and in preparing a mortar they are mixed with water; they are hardened by allowing them to dry gradually, as for instance, in the case of ordinary refractory cement. If, for instance, water-glass is used as a binding agent, the application of self-hardening masses for the purpose in question is possible only to a certain extent, for by the addition of alkali silicate the fire-proof character of the material is considerably diminished.

Now we have found that self-hardening highly refractory mortars may be obtained by using alumina sols, namely concentrated colloidal solutions of water-soluble alumina, together with substances of a spinel-like character. On using these mortars for industrial purposes they have the great advantages of a self-hardening mortar suitable also for highly refractory structures. The alumina sols are made in known manner from aluminium chloride by elimination of the chlorine and they may be applied in any desired concentration, either in a thinly liquid or viscous solution.

Among the spinel-like compounds the residue obtained by the alkaline extraction of chromium from its ores has been proved to be particularly suitable.

The masses thus produced are suitable as self-hardening highly refractory mortars as well as self-hardening tamping material or materials for repairs, painting and coating. The property of self-hardening of the spinel-like masses, for instance the aforesaid residue obtained by the alkaline extraction of chromium ores, which residues are generally in the form of a fine powder is attained and influenced by burning the masses after having been dried, so as to form a clinker-like mass, and then grinding the clinker thus obtained. The fineness of grinding the finished mixture determines the rapidity with which the mass containing the alumina sol sets. By the burning operation the product is, on the one hand, sufficiently strongly pre-sintered, and, on the other hand, rendered sufficiently reactive to the water-soluble alumina.

The mortars, tamping material, coating materials and the like made from the residue of chromium ores, are distinguished by an especially good thermal conductivity and stability to variation of temperature. Since the masses are capable of self-hardening they may be used for the manufacture of various kinds of moulded bodies which have the special advantage that they are stable in storage without being previously calcined and may be used as refractory materials.

For a part of the residue of the alkaline extraction of chromium ores or the other spinel-like compounds in the pulverised mortar there may be substituted other substances provided that the latter do not disadvantageously influence the thermal properties of the finished material; there may, for instance, be admixed other fire-proof substances, such as grogs, as well as binding agents, fluxing materials of various kinds and the like.

The following example serves to illustrate the invention, but it is not intended to limit it thereto:

The residue of the alkaline extraction of chromium ores is heated to a temperature of 1400° C, then cooled and ground. The ground product is sieved. From the sieved grain fractions a cement powder of the following composition is made:

	Per cent
The ground product passed through a sieve of 500 meshes per square centimeter but retained by a sieve of 900 meshes per square centimeter	40
The ground product passed through a sieve of 2310 meshes per square centimeter, but retained by a sieve of 3600 meshes per square centimeter	50
The ground product passed through a sieve of 10,000 meshes per square centimeter	10

100 grams of the cement powder thus obtained are mixed with 35 cc. of alumina sol of specific gravity 1.45. The mass sets after a short time and after three days it shows an average strength of 50 kilos per square centimeter. Test pieces from this mass are attacked neither by water

nor by alkali lye, in the cold as well as at boiling point.

The hardened masses show a refractoriness of more than Seger cone 38 (corresponding with a temperature above 1850° C) and soften (ta-point) under a pressure of 2 kilos per square centimeter at 1320° C. The "ta-point" is that temperature at which a cylindrical test piece under load ceases to expand as its temperature rises but is shortened by a jolt due to the softening of the piece.

The coarse fractions of the pulverised mortar may be exchanged for fire-proof grogs of the same size of grain; the property of hydraulically hardening is preferably provided by the finest fractions of the spinel-like compounds. There may also be admixed fluxing materials and binding agents of any known kind.

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Published June 1, 1943

Serial No. 273,332

ALIEN PROPERTY CUSTODIAN

ELECTROMAGNETIC CONTROL DEVICE

Hans Münz, Korntal near Stuttgart, Germany; vested in the Alien Property Custodian

Application filed May 12, 1939

The invention relates to an electromagnetic control device for use with regulators or charging switches, in particular with combined regulators and switches, for electrical installations as used in vehicles, having a current winding, disposed in the magnetic circuit outside of the magnetic core.

According to the present invention an auxiliary magnet, having its own pole core on which the current coil is wound, operates the armature controlling the contacts of the control device. This auxiliary magnet may be attached to the apparatus in a simple manner without disturbing its construction.

The invention is by way of example more particularly described with reference to the accompanying drawings in which:

Figure 1 is a vertical view, partly in section, of a combined switch and regulator together with a circuit diagram of an electrical installation as used in power driven vehicles, and Figure 2 is a vertical view of another form of the device as shown in Figure 1.

In both figures the same reference characters are employed to indicate similar parts.

Referring to Figure 1 an armature 1 and a field winding 2 belong to a lighting dynamo and a resistance 3 will be connected in series with the field winding 2 in the course of voltage regulation. The regulation of voltage is effected by means of a voltage coil 4 of a combined regulator switch unit which is disposed on an electro-magnetic core 5, carrying a current coil 6 and disposed on the yoke of a U-shaped magnet frame 7. The voltage coil 4 actuates two right angle shaped armatures 8 and 9, which are suspended by springs disposed on the ends of the limbs of the magnet frame 7. The armature 8 is adapted to actuate the contacts 10 and 11 of the automatic switch whilst the armature 9 is adapted to actuate the contacts 12 and 13 of the voltage regulator.

The armature 9 controls the voltage of the dynamo 1, 2, in known manner, by periodically opening and closing the contacts 12, 13.

A slot is provided in that limb of the magnet frame 7 associated with the armature 8 through which passes the core 14 of an auxiliary magnet. The core 14 carries a current coil 15 and is connected to a right angle shaped magnet frame 15 which is fixed to the top of the limb of the magnet frame 7.

As soon as the dynamo produces a sufficiently high voltage, the armature 8 is attracted as a result of the excitation of the voltage coil 4 and closes the contacts 10, 11 of the switch, whereupon electric current from the dynamo flows through the two current coils 6 and 15 to a battery 17 or to current consuming elements 18. As to the sense of magnetisation the action of the current coils 6 and 15 is the same as of the voltage coil 4. The magnetisation of the core 14 produced by the current coil 15 attracts the limb of the armature 8 which is directed towards the core. There are, then, two magnetic fluxes present. One passes through the magnet core 5, through the half of the magnet frame 7 assigned to the switch and through the armature 8. The other passes through the auxiliary magnet core 14, through the magnet frame 16 and through the limb of the armature 8 which is directed towards the core 14. Consequently this limb comes to rest on the end of the core 14 so that in this position, the air gap disappears and the armature 8 adheres to the end of the core. The armature 8 thus becomes insensitive to vibration produced during driving of the vehicle on which the device is mounted and that there is no danger of such vibration opening the switch contacts 10, 11.

The core 14 of the auxiliary magnet acts as an additional pole surface beyond the main core 5 to attract the armature 8. Thus the regulator and the switch though constructed in one unit become more independent from one another. The regulator armature 9 can swing only under the influence of the voltage coil 4 and the current coil 6 both constructed accordingly to the conditions of regulation, while the switch armature 8 is strongly held by the additional pole surface of the core 14, thereby holding firmly the contacts 10, 11 closed.

If the voltage generated by the dynamo falls below that of the battery so that a reverse current flows through the current coil 15 of the auxiliary magnet 14, 15, then the armature 8 is released from the core 14 and opens the switch contacts 10, 11. This arrangement has the advantage that the switch responds even to a small reverse current.

The auxiliary magnet removes the possibility of any chance short circuit in the current consumer circuit opening and closing the switch contacts in rapid sequence, in the event of a strong current, and consequently damaging them. The customary use of a bi-metallic construction for the switch contact springs is therefore not necessary in this case.

As will be seen from the drawing, the application of the auxiliary magnets 14, 15 to the top of the limb of the magnet frame 7 results in a very

compact construction. The approved construction of regulator switches with a U-shaped magnet frame is retained.

Referring to Figure 2 the arrangement differs from that of Figure 1 in that the armatures **8** and **9** are suspended by springs **19** and **20** disposed on supports **21** and **22** which are fastened to the limbs **23** and **24** of the magnetic frame **7** and that the core **14** carrying the current coil **15** is disposed on the inner side of the magnet limb **23**.

The construction of Figure 2 is more simple than that of Figure 1, for there no separate angle shaped core supports are needed because the core **14** is disposed directly on the limb **23** of the magnetic frame **7**.

The limbs **23**, **24** do not as hitherto known reach to the horizontal limbs of the angle shaped armatures, but are shortened. This arrangement has an advantageous effect on the magnetic flux. The magnetic leakage is reduced.

The auxiliary magnet makes it possible to provide the main electromagnet in a simple manner with a winding which is not wound on the main core. Hitherto a winding of this sort was pushed on to the limb of the magnet frame, which was a complicated process from the point of view of fastening the armature and arranging the contacts.

As the auxiliary core **14** has a small diameter as compared with the main core **5** the current coil **15** which is wound on to it requires only a short winding.

As shown in the drawings by way of example the main core **5** carries a voltage coil **4** and a current coil **6** for regulation purposes.

The auxiliary magnet **14**, **15** for the automatic switch may, however, on the omission of the current coil **6** be applied to regulator switches which have only a voltage coil for regulation.

HANS MÜNZ.

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H. MÜNZ
ELECTROMAGNETIC CONTROL DEVICE
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Serial No.
273,332

Fig.1

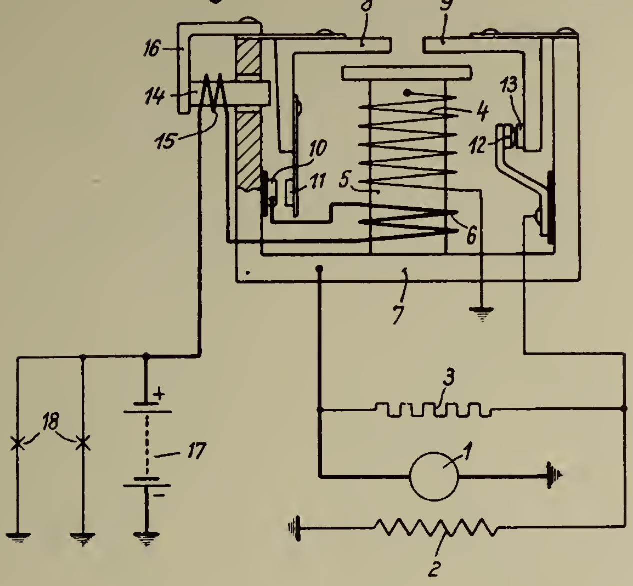
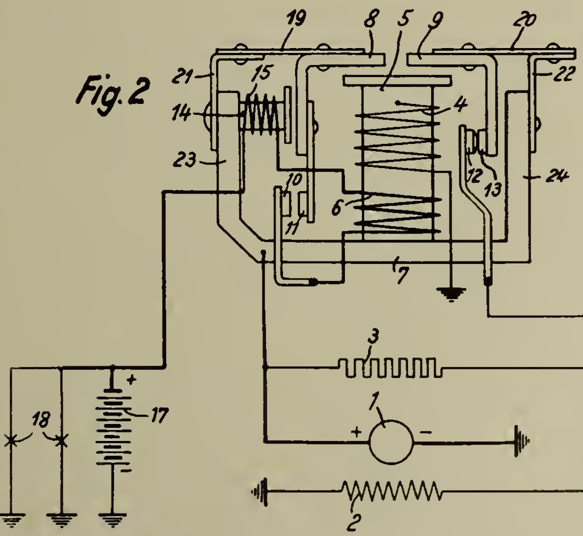


Fig.2



Inventor
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his attorney

ALIEN PROPERTY CUSTODIAN

GUNS AND FIREARMS

Albert Alexandre Augustin Darche, Bondy, France; vested in the Alien Property Custodian

Application filed May 13, 1939

The invention has for its object improvements in guns and firearms, in order to increase, for a given pressure and calibre, the useful energy at the muzzle and, consequently, the muzzle velocity of the projectile.

Reference is made to the fact that:

1. For firing, with the same maximum pressure, a projectile of given calibre and weight, it is possible, by increasing the charge of powder and decreasing the quickness of the powder, to increase the muzzle velocity of the projectile up to a certain limit (maximum powder effect).

Then, the increase of the charge, conjugated with the decrease of the quickness, not only does not procure any gain, but leads to a decrease of the muzzle velocity.

2. Keeping the same quickness as for the maximum powder effect, it is also possible to increase the charge if the density of charging is simultaneously decreased. This therefore leads to a double increase of volume of the powder chamber.

The powder acts as if it were less quick, pressure is set up more slowly and the result is the same as in case (1), that is to say that the increase of the charge does not further increase the muzzle velocity.

3. The maximum pressure will moreover only be maintained so long as "undulatory pressures" do not occur. The same will have a greater tendency to occur as:

a—The increase of the size of the powder chamber, on the one hand, and

b—The decrease of the charging density, on the other hand, juxtapose their effects and tend to cause irregularity of ignition and of combustion.

In short, with the classical arrangements, for the same length of tube, and beyond the maximum powder effect, it would appear that it is only possible to increase the muzzle velocity of the projectile by increasing the maximum pressure (thicker and heavier tube; quicker wear; projectile with less capacity for the explosive).

The applicant has, on the contrary, been led to discover that, while retaining the charging density, if an auxiliary volume can be placed in communication with the main volume:

a—At a predetermined instant,

b—With controlled progressiveness, and

c—An essential condition, without the possibility of "undulatory pressures" occurring, it is possible to act on the development of the pressures so as to obtain the results which would be produced by a powder—if it existed—of automatically variable quickness during combustion.

It is thus possible to cause, for the same maximum pressure and the same charging density:

1. the pressure to approach quickly its maximum value,

2. combustion to be prolonged, in this case at substantially constant pressure, during a part of the travel of the projectile,

3. the pressure then to be maintained, up to the muzzle, at a high mean value.

Consequently, the energy transmitted to the projectile is considerably increased.

The invention consists in the combined use of one or a plurality of auxiliary volumes, and of arrangements which enable the indispensable conditions mentioned to be fulfilled.

In the accompanying drawings which are given solely by way of example:

Fig. 1 shows, for the same maximum pressure, the comparative mechanical diagrams of a usual gun and of a gun according to the invention;

Fig. 2 shows diagrammatically a first embodiment of the invention;

Figs. 3 and 4 show a second embodiment, in longitudinal section in Fig. 3, and in Fig. 4 in transverse section along IV—IV of Fig. 3.

Figs. 5 and 6 show two other embodiments.

Let it be assumed, Fig. 1, by way of example, that OABCDEO is the (pressure-volume) mechanical diagram of an ordinary gun.

For the same charging density and the same powder, the charge of which is increased, a diagram will be obtained, according to the invention, that tends to become similar to the one shown at OA'BC'D'EO.

Comparison with the usual diagram shows that the pressure increases first of all much quicker according to OA'.

Then the gradual intervention of the auxiliary volume inclines the diagram along A'B.

Without necessarily occurring at the same point B, the maximum pressure remains the same in the two diagrams.

Owing to the initial increase of the charge and simultaneously of the gas emitting area of the powder, the evolution of energy, which is much greater than for the usual gun, then maintains the pressure of the diagram OA'BC' practically constant from B to C'.

Said diagram then includes the downwardly inclined arm C'D' and closes along D'EO.

The increase of useful area, which is shown by the hatched surface of Fig. 1, involves an increase of the muzzle velocity and of the momentum of the projectile.

As can be seen, by extending the diagrams, respectively along DF and D'F', an elongation of the tube produces, according to the invention, a greater increase of momentum than can be obtained in the case of the ordinary gun.

Various combinations are obviously possible.

In particular, for the same charging density and the same maximum pressure, it is possible to obtain an increase of the muzzle velocity while retaining the same charge, but using a quicker powder.

For the same muzzle velocity, it is possible to effect a reduction of the maximum pressure.

It is further possible to combine increases, either of the charge, or of the quickness, or of both simultaneously, with the maintenance or the reduction of the maximum pressure.

A number of diagrammatical examples are shown in the accompanying drawing.

In the example of Fig. 2, the gun tube has been shown at 1 and the powder chamber at 2. An additional auxiliary volume 3 forms, for the gases evolved by the combustion of the charge, an "expansion chamber" which enables the maximum pressure to be kept at the same value, or at a lower value, while enabling an increase to be effected in the charge or in the quickness of the powder, or in both simultaneously.

Said expansion chamber 3 forms, about the rear part of the tube 1, an annular volume which is concentric, or if necessary eccentric with respect to the tube 1.

Between the powder chamber 2 and the rear part of the tube 1 a space has been provided. The volume thus limited communicates, through its rear base, with the powder chamber 2 and through its lateral wall 4 with the expansion chamber 3.

Said volume is first of all occupied by the projectile 5. But as soon as same has sufficiently moved in the tube 1, communication is set up between the powder chamber 2 and the expansion chamber 3.

According to the distance the projectile 5 has to move forward in the tube before it uncovers the lateral communication 4; according to the passage cross-section given said communication 4; and finally according to the volume of the expansion chamber 3, it is possible to control and regulate the law of the development of the pressure during the combustion of the powder.

For a given value of the maximum pressure B, it is therefore possible to increase the charge and the useful area of the diagram.

During the period of rise of pressure, and then subsequently, the volume which can be occupied by the gases evolved by the combustion no longer depends essentially on the volume produced by the movement of the projectile 5.

It is known that in the usual guns and particularly during the preliminary period, called "forcing" period of the projectile, intense leaks occur towards the front. These cause metal to be carried away which is deposited further on and obstructs the grooves (metal fouling).

Owing to its presence, the expansion chamber 3 causes in this case, on the path of the leaks and behind the band 6 of the shell, a sudden expansion which considerably reduces the final magnitude of said leaks and consequently their erosion effect.

The delay caused in placing the expansion chamber 3 in communication with the volume 2 occupied by the gases of the powder, accelerates the beginning of the rise of pressure and the forcing of the projectile.

As has been shown in Fig. 1 (hatched surface OA' BAO), a first increase is also obtained of the useful surface of the diagram.

Instead of using, as in the case of Fig. 2, a single auxiliary volume, a plurality of same could be used, the shapes, sizes and positions of which could be varied, said volumes being successively or simultaneously placed in communication, by the movement of the projectile, with the volume occupied by the gases evolved by the combustion of the charge.

It is known that the sudden expansion of the gases of the powder may produce, in their mass, undulatory movements which cause violent dynamic overloads on coming into contact with the walls.

With an arrangement like that of Fig. 2, or with any arrangement based on the same principle, the initial cylindrical gaseous stream is subjected laterally to a sudden expansion by means of curved waves which are not adapted to the production of undulatory pressures.

As stated, it is indispensable to fulfil this condition, otherwise the gun would be quickly dislocated.

In the example of Fig. 3, the case has been considered diagrammatically of two expansion chambers 3 and 3' which become successively operative. In this example, the large passage cross-section 4 provided for filling the chamber 3 enables same to act extremely quickly. On the other hand, according to the same example, a much more gradual effect is provided for the second chamber 3' having a reduced passage cross-section 4'.

In the example of Fig. 3, the case has been diagrammatically considered of the application of the invention to an existing gun, in order to use, while retaining the same pressure and the same charge, a projectile of reduced calibre, the muzzle velocity of which will be very much increased.

An auxiliary tube 7 of reduced calibre is fitted inside the primary tube 1 of given calibre.

The expansion chamber 3 which, in the example shown, is assumed to be annular and concentric with the rear end 7' of the tube 7, is closed towards the rear by a separate plate 8 on which the charge of powder bears.

An additional connection of the auxiliary tube 7 is effected, towards the front of the primary tube 1, by the intermediate part 9.

By the use of shims, such as the one shown at 10 in Fig. 5, provision may be made for shifting the auxiliary tube 7 longitudinally with respect to the primary tube 1 and for varying the effect of the expansion chamber 3 by modifying its volume and the area of the passage cross-section 4, this latter modification being generally predominant.

By replacing the auxiliary tube 7, it is possible to change the calibre.

In the example of Fig. 6, a single concentric annular expansion chamber 3 is also used, but same is no longer arranged, as in the case of Fig. 2, round the rear end of the tube 1, but is lodged in the breech 11 itself.

The annular communication passage 4 is thus located towards the front of the expansion chamber 3.

The tube 1, which is screwed in the breech 11, can be shifted longitudinally.

The study of the comparative diagrams of Fig.

1 shows that, according to the invention, it is advantageous to provide a considerable elongation of the tube whereby, on the other hand, the pressure at the muzzle is reduced.

In order to obtain said elongation, without running the risk of longitudinal bending that might make firing impossible, use is made of the considerable transverse difference of dimensions which can be obtained between the outer wall of the expansion chamber **3** and the tube, so as to provide same with one or a plurality of additional connections.

A kind of "reinforced beam" is thus formed.

The principle of reinforcing the tube by means of external beams having a large moment of inertia has been shown diagrammatically in chain dotted lines **12** in Fig. 2. One or a plurality of trunconic tubular parts may be used, having their large base turned towards the rear.

Said beams may be continued so as to form a hoop round the breech. Since rigidity is more desirable than strength in such beams of girders, alloys of the light metals may be used (duralumin for example).

In Fig. 5, it is the primary tube **1** of the gun itself which forms the reinforcing element of the inner auxiliary tube **7**.

For cooling the tube, a substance which is solid at ordinary temperatures, but having a low melting point, may be interposed between the tubes **1** and **7**, in the intermediate space **13** (Fig. 5). The heat passing through the tube **7** will first of all be used for supplying, then for maintaining the latent heat of fusion of said substance, so long as the internal wall of the outer tube **1** is not at a temperature which is at least equal to the temperature of fusion of said substance. Then the latent heat will continue to be transmitted from the tube **7** to the tube **1** through the liquid obtained. In this manner, the temperature of the inner tube **7** will be very substantially lowered.

Of course, all the necessary arrangements will be provided for ensuring the liquid-tightness of the space which is intended to form a liquid chamber for the molten substance.

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BY A. P. C.

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GUNS AND FIREARMS

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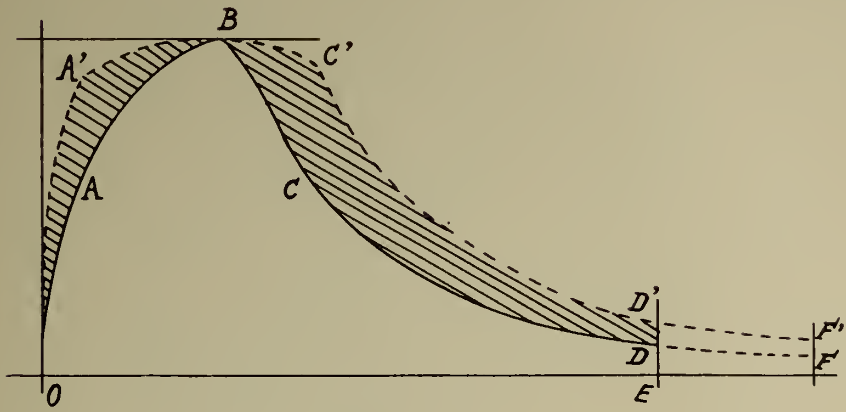

Fig. 1

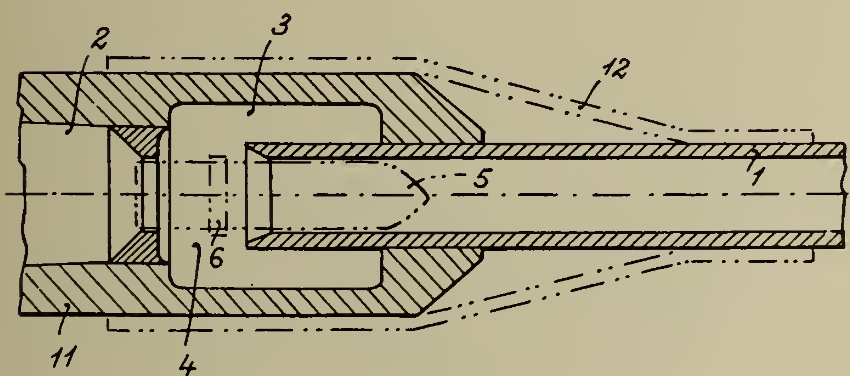

Fig. 2

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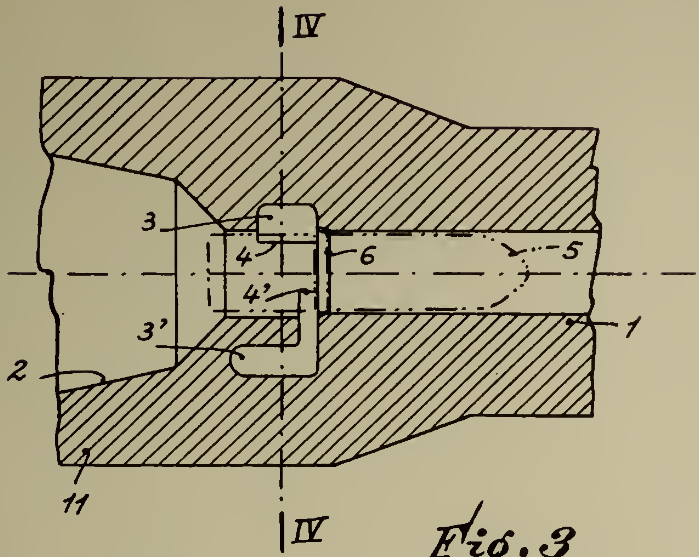

Fig. 3

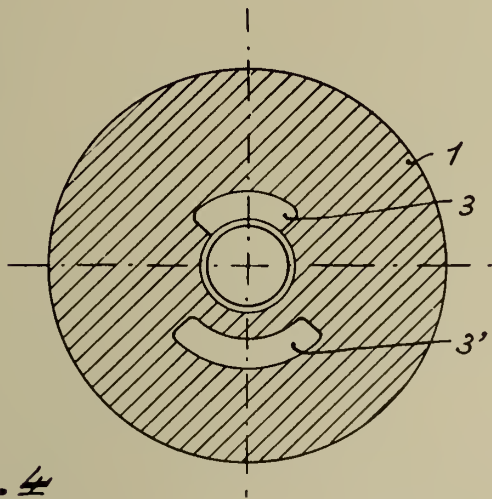

Fig. 4

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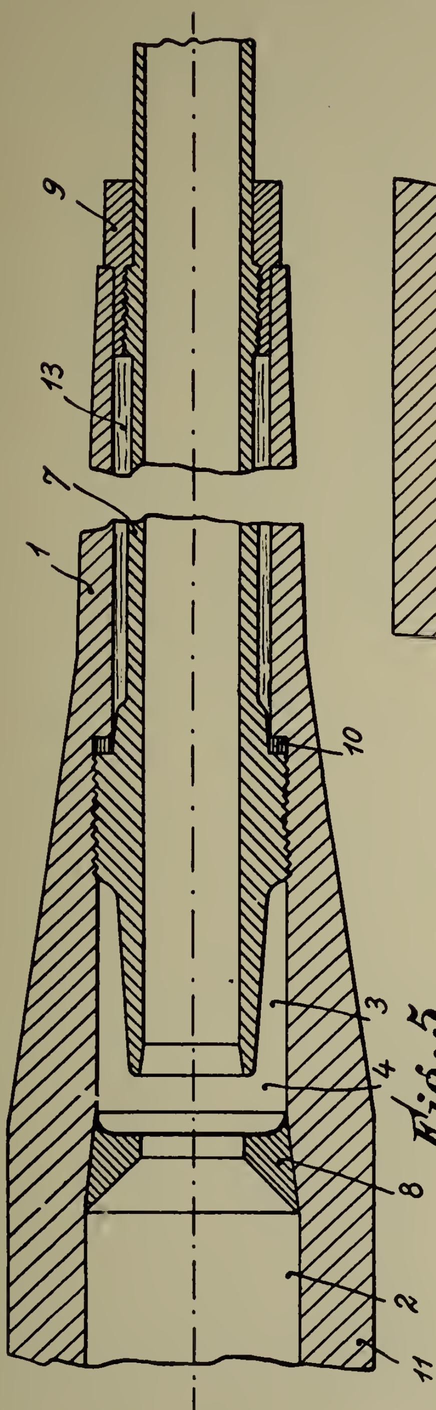

Fig. 5

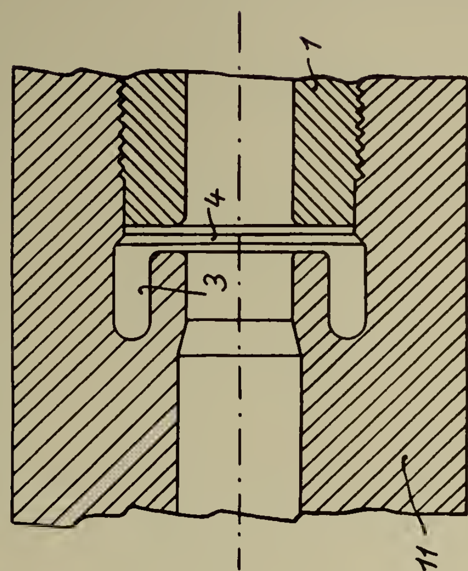

Fig. 6

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ALIEN PROPERTY CUSTODIAN

GIRDERS FOR AIRCRAFT STRUCTURE

Kurt Cyron and Erich Wessel, Dessau, Germany; vested in the Alien Property Custodian

Application filed May 16, 1939

The present invention relates to the design of girders or spars which run from the one side of an aircraft structure to the other and consist of a plurality of longitudinal parts to be connected with one another.

Such girders are used in aircraft, for instance in the wings, tail groups, and the like. It is necessary to build these girders of several parts in view of joints in the structure. Such joints are caused, e. g. by the transverse subdivision of the wing because of the insertion of the fuselage, or by the arrangement of the so-called intermediate pieces of the wing. The portion of the girder located between the points of separation must be provided on both sides with attachment members to which the other parts belonging to the girder may be attached.

In order to make ourselves fully understood, the term "longitudinal member" will be used in the specification hereinafter and in the claims to denote those portions or members of a girder which in a conventional girder type are located near the top and the bottom of the girder when the latter is in a horizontal position, and which usually are farthest remote from both sides of the neutral zone when the girder is subject to bending loads; and the term "longitudinal element" is to indicate one of the alined parts of which a "longitudinal member" subdivided transversely of its longitudinal extension is composed.

In the conventional design and construction of the afore-mentioned joints or points of separation, the longitudinal members of a girder are composed of a plurality, in general three, longitudinally alined elements, and the attachment members are so arranged on the longitudinal members of the girder that to each end of the middle element of a longitudinal member an attachment member is riveted which is separately made and provided with a threading. For this purpose, every attachment member must have a flange-like collar or projection to be fixed to the middle one of the longitudinal elements for effecting the connection. The longitudinal elements of the other girder parts to be attached to the longitudinal elements of the middle girder parts are secured to the attachment members by means of cap units. The design of this type shows, on each longitudinal member of a grider, two fields of rivets the elimination of which is highly desirable since they weaken both the longitudinal members and the attachment members. Moreover, the attachment members riveted to the longitudinal members of the conventional girder type must have a certain length in order to safeguard the necessary strength. This is particularly inconvenient in the case of a tubular design of the middle element of a longitudinal member into which the comparatively long flange-like portions of the attachment members, serving for the riveting must be shoved from both sides. In that event, the middle longitudinal member must have a certain minimum length which makes it hardly possible to bridge very shortly distanced points of separation in this manner. For this reason the attachment members have been welded to the elements of the longitudinal members in another well-known structure. However, this structure requires two welded regions the elimination of which is desirable from an economic view point as well as from the view point of strength, quite aside from the fact that the welding causes a further increase in the consumption of material.

The purpose of the present invention is to eliminate these drawbacks. The invention contemplates to provide a longitudinal member of a girder, in which the mentioned difficulties and drawbacks are avoided by the arrangement of the attachment members on the longitudinal member, and in which, moreover, material, weight and production costs can be saved, and the strength and rigidity of the connection of the longitudinal elements can be very considerably increased.

According to the invention, the attachment members are united with the middle element of a longitudinal member to a one-piece body so that any riveting and welding is avoided. The design of the attachment bosses or heads, and that of the longitudinal member as well as the connection of the longitudinal member elements with each other may be optional, screw connections, bolt connections, or bayonet couplings being suited to the purpose. The longitudinal member proper is preferably designed as a so-called open section, having a cavity open on a portion of its circumference. The cross section of the member, which may be e. g. U- or T-shaped passes gradually over, at the ends of the longitudinal elements composing the longitudinal member into the thickened round shape of the connection head, advantageously in such a manner that the center of gravity of the cross-section lies approximately on the axis of the head which may be threaded.

Further objects and details of the invention will be apparent from the description hereinafter and the accompanying drawing illustrating

three different embodiments thereof by way of example. In the drawing:

Fig. 1 shows an open section, middle element of a longitudinal member.

Fig. 1*a* is a cross-section along line 1*a*—1*a* of Fig. 1.

Fig. 2 is a round section longitudinal element with bolt connection.

Fig. 3 shows likewise a round section with a thread bayonet coupling, and

Fig. 3*a* is a cross-section along line 3*a*—3*a* in Fig. 3. Fig. 4 shows the whole arrangement of the girder.

According to Fig. 1 and 1*a* the longitudinal member comprises the middle element 1 and the lateral elements 10, 11. Element 1 has a flat U-shape in cross-section, that is to say it has a web 4 with lateral flanges 5, 6 and 7. Towards the ends of the longitudinal element 1, this profile or section passes gradually over into the round form of connection or attachment heads which have a cylindrical boss and a thread carrying extension 8. The attachment head may have a hole or recess, with the object or reducing the weight into which a mushroom-like piece 9 is inserted. The attachment heads of the longitudinal element 1 may be connected with the longitudinal elements 10, 11. The end portion of each of the latter has a hollow ball shape so that its interior surface snugly fits the arch or camber of the piece 9. The nuts 12 provided on the end portions of the longitudinal elements 10, 11 may be screwed upon the threading of the attachment heads and thus hold the longitudinal elements firmly together. The cross-section of the longitudinal elements has such a position relatively to the attachment heads that is center of gravity S (Fig. 1*a*) falls on the axis of the connection heads.

In place of the screw connection, a bolt connection is shown in the embodiment of Fig. 2. In the two lateral ends of the longitudinal element 1 tapered recesses 14 are provided in the axial direction. The end portions of the longitudinal elements 10, 11 to be attached are shaped as truncated cones in such a manner that they may be pushed into the recesses 14. Both parts, viz. the attachment head of element 1 and the end portion of the element 11 to be attached to element 1, have holes running perpendicular to their axes. When the longitudinal element to be attached is inserted into the attachment head, said holes are brought to register and are engaged by a connection body 15 such as a bolt, wedge or the like, driven into the attachment head of the middle element 1 in a diametrical direction.

According to Figs. 3 and 3*a*, the attachment head of the longitudinal element 1 is designed as an interiorly threaded boss 16 and the end portion of the longitudinal element to be attached thereto is designed as a screw stud 17. Both the interiorly threaded boss and the screw stud have recesses 18 and 19 in their threaded portions which make it possible to push or telescope them readily and without interference by the threaded portions, into each other in the axial direction until the screw body 17 comes to a stop on the bottom of the interiorly threaded boss 16 on the longitudinal element 1. Upon reaching this end position, locking may be effected by an axial turning in the manner conventional in bayonet locks.

In Fig. 3*a* the interiorly threaded boss 16 of the longitudinal element 1 is shown in cross-section, and also the screw body 17 of the longitudinal element 11, the body 17 being turnable in the boss 16 in the direction of the arrow for the purpose of locking.

In Fig. 4 the whole arrangement of the girder unit is illustrated, which runs from the one side of an aircraft structure to the other and consists of a plurality of longitudinal parts connected with one another. On account of the insertion of the fuselage 20 the girder is subdivided transversely of its longitudinal extension and comprises the longitudinal elements 21, 22, 23, 24, 25, 26.

In the middle part of the longitudinal member which is embraced by the fuselage 20 the longitudinal elements 21 and 22 are joint together by means of a sheet metal plate 27 forming the web of the girder.

In the outer portions the longitudinal elements 23, 24 and 25, 26 are joint together by diagonal bracing members 28. The longitudinal elements 21 and 22 lying within the middle part embraced by the fuselage 20 are illustrated in detail in Figs. 1–3*a* of the drawing.

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PUBLISHED

JUNE 1, 1943.

BY A. P. C.

K. CYRON ET AL

GIRDERS FOR AIRCRAFT STRUCTURE

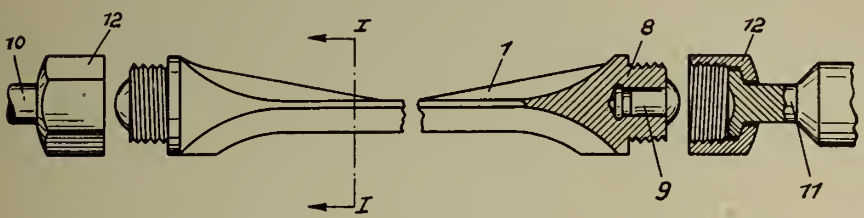
Filed May 16, 1939

Serial No.

273,879

2 Sheets-Sheet 1

Fig.1



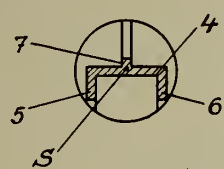


Fig.1a

Fig.2

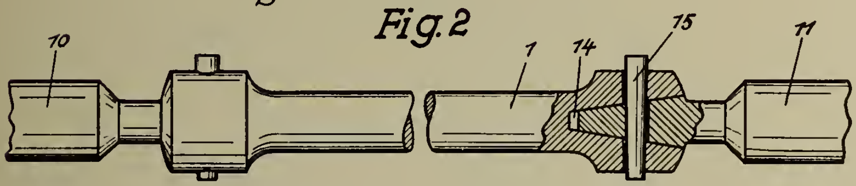
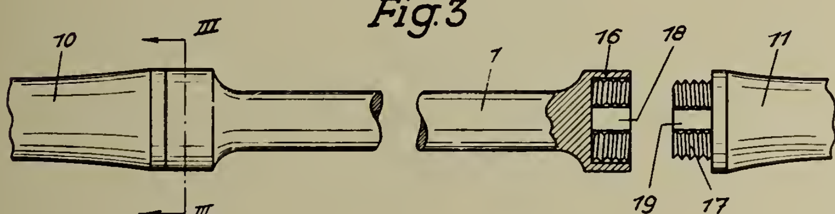


Fig.3



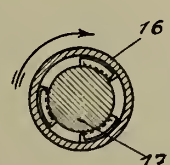


Fig.3a

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Serial No.
273,879
2 Sheets-Sheet 2

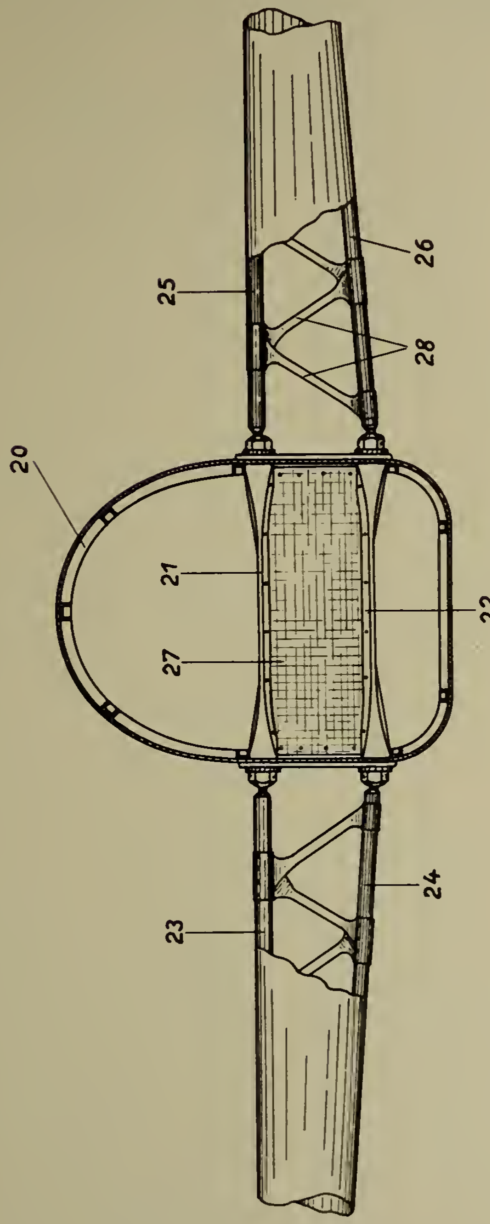

Fig. 4

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Serial No. 275,566

ALIEN PROPERTY CUSTODIAN

OPAQUING AGENTS MAINLY COMPRISING ZIRCONIA AND PROCESS FOR PREPARING SAME

Maxime Paquet, St. - Maure - des - Fosses, and Jacques Ourisson, Paris, France; vested in the Alien Property Custodian

No Drawing. Application filed May 24, 1939

The invention relates to novel opaquing agents which are applicable, in particular, to the manufacture of vitrified enamels, and a process for preparing same.

Said opaquing agents mainly comprise zirconium compounds and are prepared from natural zircon (zirconium silicate) or similar starting materials containing zirconia and silica and are utilizable for opaquing vitrified enamels in general, but more particularly enamels for cast-iron and hard enamels, having a relatively high melting point, which are used in the pottery industry for coating the surface of bricks, tiles, earthenware, stoneware, porcelain, etc.

Endeavours have been made to use zircon for opaquing enamels by introducing it when the frit is fused. In fact, zircon used in sufficient quantity imparts a certain opaqueness to frits. But in order to obtain a suitable opacity, which moreover is not that which can be obtained with zirconia it is necessary to add such large proportions of zircon that they are no longer compatible with the other properties of the enamel, a fact which limits the application of this process.

For this reason, products which are more or less enriched and have a higher ZrO_2 content, are generally prepared from zircon. This practice offers drawbacks, in particular owing to the costly chemical treatment required for eliminating the silica, a fact which limits its use.

Finally it has been proposed to prepare from natural zircon well-defined products such as basic zirconium silico-borate, alkaline silico-zirconates, double silicates of zirconium and magnesium, or of zirconium and zinc, etc. so as to involve the zirconium in a chemical compound which is more efficacious than zircon for opaquing frits. But such well-defined compounds, which can only be obtained under very specific conditions and at high temperature, have their sphere of use limited by the relative proportions of the components, necessarily due to their nature as a well-defined product, and by their particular properties, such as their crystalline structure for example.

The present invention enables these drawbacks to be avoided and permits of the preparation by a simple and economical method, from natural or previous enriched zircon, of opaquing agents which are quite comparable, as regards their efficacity in certain enamels, to good quality purified zirconia, while only introducing into the enamel substances which usually form part of their compositions.

The invention consists in calcining ground natural zircon in the presence of fluxes, at a suitable temperature which in practice is between 850° and 1300° C. with substances capable of decomposing it so as to form a substantially colourless amorphous vitreous substance which is slightly fusible or is very viscous at the temperature of preparation of the enamels for which these opaquing agents are intended, and in which vitreous substance zirconium compounds are engaged, such in particular as zirconia or undissolved zircon.

The substances which have given the best results for this manufacture are magnesium and aluminum oxides which produce, with the zircon, vitreous substances which are but slightly fusible. It is also possible to use the oxides of zinc, calcium, barium or compounds of these oxides which are capable of producing same during reaction.

The tables (J. Amer. Ceramic Soc. (1938)—16 to 10, Figures Nos. 36, 37, 39, 43, 45) give the following values for the melting point of the eutectics of the various oxides with silica:

	Degrees centigrade
SiO_2—MgO	1543
SiO_2—Al_2O_3	1545
SiO_2—CaO	1432
SiO_2—ZnO	1436
SiO_2—BaO	1370

and it has been observed that in a general manner, the results obtained are better as the melting point of the possible eutectic is higher.

It would appear, without the inventor's considering this hypothesis as final, that the vitrified substance obtained is a solid solution in silica of zirconia ZrO_2 and of the oxide used, MgO for example. In this solid solution, there is, in the dispersed state, either zirconia ZrO_2 or zircon (SiO_2, ZrO_2) according to the operating conditions.

In order to lower the temperature of treatment, fluxes are added which are intended to enable the vitreous substances to form at a relatively low temperature, said vitreous substance remaining however very viscous, such as the compounds of the alkali metals and in particular: KCl, KNO_3, Na_2CO_3, K_2SO_4, borax, KF, or again cryolite, etc. or their mixtures, or again substances having the same action, which consists in ensuring contact between the powders by the local formation of fusible compounds at a temperature

adjacent that at which the operation is being effected.

It should be observed on the other hand that instead of starting from ground natural zircon, it is possible to use similar compounds, containing ZrO_2 and SiO_2, which are natural or treated, or enriched in ZrO_2 by means of a previous treatment.

As regards the relative proportions of the ingredients of the mixture, these may be varied within wide limits; however the best results have been obtained by taking, for one molecule of zircon to be treated, 0.2 to 2.0 molecules of additional substance, such as MgO or Al_2O_3, and preferably between 0.4 and 1.0 molecule.

The quantity of flux to be used is less than that of the previously mentioned ingredients of the mixture, and depends on its activity. It will be about 0.1 to 1 molecule of flux per molecule of additional substance such as MgO or Al_2O_3. The best results have been obtained by taking for example:

	Molecules
MgO or similar compound	0.6 to 0.9
K_2O or similar compound	0.4 to 0.1

It has been observed that cryolite is a very active flux, and that in a general manner the compounds of potassium are preferable to those of the other alkali metals.

It is also possible usefully to add fluorides, chlorides, borates, boric acid, these substances exerting a favorable action on the colour of the product obtained, and contingently also on its opaquing power.

The temperature of calcination will be such that there is a beginning of agglomeration or even a beginning of partial fusion according to a phenomenon similar to clinkerization, and will usually be between 850° and 1300° C. The duration will vary with the temperature. Satisfactory products can be obtained at very different temperatures if the duration of the calcination is made to operate in the reverse direction to the temperature. For example, calcining may be effected for 48 hours at 900° C. or for 2 hours at 1200° C.

The progress of the reaction during calcination can be followed by means of chemical tests.

For example, if the zircon is calcined by the process described in the presence of magnesia, it is found that as the reaction progresses, the magnesia can no longer be extracted by means of a concentrated solution of ammonium chloride. It is found at the same time, that relatively to its initial value, the silica has as gradually increasing solubility in hydrofluoric acid, and may become totally soluble therein.

If a mixture containing zircon and alumina is calcined, the same gradually increasing solubility of the silica occurs as the reaction progresses.

Similar tests enable the calcination to be followed in the other cases.

It has been found that in order to obtain a satisfactory product, it is necessary for an appreciable fraction of the zircon used to have reacted, but it is not necessary for the whole of the zircon to have been decomposed, so that the product obtained may contain a certain amount of unattacked zircon, which is visible under the microscope and can be identified by its X-ray spectrum.

The following examples illustrate the preparation of the products which are the object of the invention.

Example 1

Take:

	Kgs.
Zircon	1.000
Al_2O_3	275
Cryolite	150
Na_2CO_3	150

Intimately mix and calcine for 16 hours at 900° C. Allow to cool. If treated with hydrofluoric acid it is found that about 90% of the mass dissolves and that the residue only contains very little silica.

Example 2

Mix:

	Kgs.
Zircon	1.000
MgO	110
Al_2O_4 in the form of hydrated alumina	135
Cryolite	165

The mixture is ground into a thin paste in water, is dried and calcined for two hours at 1220° C.

The product obtained is compact and white. It is allowed to cool and ground in water.

Example 3

Intimately mix by moist grinding:

	Kgs.
Zircon	1.000
MgO	200

Add to the paste a solution containing:

	Kgs.
$MgCl_2.6H_2O$	50
Na_2CO_3	100

The mixture is made homogeneous, dried and calcined for two hours at 1200° C. then poured into water, ground and dried.

In this example, Na_2CO_3 may be replaced by 50 to 100 Kgs. of KNO_3 or $NaNO_3$.

Example 4

Intimately mix by moist grinding:

	Kgs.
Zircon	1.000
Magnesia	220
Cryolite	150

Add to the paste a solution containing:

	Kgs.
Na_2CO_3	75

Dry and calcine for 24 hours at 900° C. then allow to cool.

It is found that nearly all the magnesia has become insoluble in a concentrated solution of ammonium chloride.

If the product is treated with hydrofluoric acid, it is found that about 90% dissolves and that the residue only contains a few per cent of silica.

Such opaquing agents suitably ground may be used for enamels in general and even for enamels for earthenware, since the freed zirconium compound it contains is protected from dissolving by the slightly fusible or infusible vitrified substance in which it is engaged.

These products are directly utilizable as opaquing agents for vitrified enamels, but more particularly for enamels suitable for cast-iron, into which they are introduced during the fusion, or as an addition in the mill for enamels for pottery. They behave therein in the same manner as zirconia (ZrO_2) used in the same manner, and give, in the same proportion as ZrO_2, similar and in certain cases greater opaquing effects.

The opaquing agents thus obtained comprise a zirconium compound engaged or dispersed in a vitreous mass mainly comprising silica, zirconia, and a substance such as MgO or Al_2O_3, optionally with alkali oxide or salts. Said vitreous mass is slightly fusible and protects the free zirconium compound from being quickly dissolved when it is being used for pottery manufacture. The vitreous part does not give any spectrum so that X-ray examination only shows a diagram of the free zirconium compound such as spotty zircon, on which is often superposed a diagram of lines of crystallized ZrO_2 either in the baddelyte form, or in the tetragonal form, or in both forms at once.

In the case in which the additional substance is magnesia, a considerable fraction of same has become insoluble in a concentrated solution of ammonium chloride.

The silica of the starting material has undergone a transformation that has made it more soluble in hydrofluoric acid than the silica of the initial material.

MAXIME PAQUET.
JACQUES OURISSON.

Published June 1, 1943

Serial No. 279,960

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF PURE IRON OR IRON ALLOYS WITH STARTING FERROUS MATERIALS, ETC.

Vincenzo Arata, Rome, Italy; vested in the Alien Property Custodian

No Drawing. Application filed June 19, 1939

The present invention relates to a process for the production of pure iron or iron alloys (that is a product containing impurities (S, Ph, Mn, Si, C) in a quantity not superior totally to 0,10%) starting from ferrous materials, above all finely subdivided particularly of ferric sands, residual muds from the extraction of aluminium, pyrite's ashes and similar natural or artificial substances containing not less than 20% of the metals to be extracted and the relative product.

It is well known that the immediate utilisation of ferric sands or of small iron ore bearing beds is impossible with the normal systems of production of iron cast out of a high furnace owing to the dustlike state in which the material is found or the great distance of the beds from the places where the working is done, this meaning too high expenses of forwarding, compared to the cost of production. On the other hand, owing to the insufficient consistency of said ore bearing beds and above all to their excessive extension it is not possible to construct important works not far from them because they would be exhausted before the cost of construction could be amortised.

Further on for these dustlike minerals a preliminary agglomeration is necessary to acquire the possibility of using them in the high furnace.

The process according to the present invention allows to utilise said ore bearing beds of ferrous material and to obtain pure iron or iron alloys. In order to reach this object the material is utilised in the same physical state in which it is extracted, such material then being treated in the electric furnace and iron instead of pig iron, extremely pure, is obtained, thus the further treatment being avoided which is required by cast iron for the transformation into common iron or steel.

The establishment comprises an electric furnace even of a small efficiency and relatively cheap and may be, above all, displaced from a bed to another with a moderate expense so that it is possible to utilise beds even of a limited efficiency and to produce blocks to be sent afterwards to the centers of utilisation.

On the other side the pure iron obtained has such mechanical properties that this iron can fully replace copper and brass for instance in the production of artillery cases and projectiles in general, of objects requiring a good resistance against corrosion and rust and possessing at the same time a great capacity of being pressed.

Owing to its very low contents of carbon the iron obtained according to the process of the present invention may be alloyed with special metals for the production of unoxidisable steel much cheaper than it is usually obtained; special steel sorts for very peculiar applications characterised by a great number of desirable properties as a great resistance to considerable strains. The iron may have further important applications which may be perhaps foreseen but not singularly specified.

In general the process forming the subject matter of the present invention consists in the introduction in a convenient electric furnace of a mixture of ferrous material of a convenient reducing means of an acid or alcaline basic addition, according to the nature of the reduction material, finely subdivided and intimately mixed. Said mixture is then progressively charged in order to be entirely melted. From this point forward great care is required to prevent the furnace's walls from being corroded by the slag. To this effect it is convenient to charge the mixture always towards the walls in order to cool the periphery of the bath. Eventually large pieces of the alcaline or acid basic material may be thrown against the walls. This first phase of the process serves to effect the reduction of the iron ore and may be prolonged till the bath contains but 2% of silicum or of the reduction means employed. The slag may be then removed. Should on the contrary it not be possible to keep the slag so long in the furnace this first slag is flown off and more iron ore is charged in the furnace with as much alcaline or acid basic material. Atfer the complete fusion of the bath the casting may take place. Should iron still contain a positive quantity of silicium or of another reduction means or other impurity, the operation may be repeated by conveniently adding a suitable flux.

In order to better illustrate the invention the following example of a particular application is given:

A mixture comprising

	Kg
Ferric sand (65% iron)	200
Silicium iron at 45%	120
Dried calcium oxyde	20

is placed in a convenient electric furnace for instance in a Three-Phase Heroult Furnace of 1 ton charge with a not carburising lining in the case a product deprived or nearly deprived of carbon is wanted. Care should be taken that arc heating occurs in precedence accurately avoiding any fall of coal from the electrodes of the furnace as

also any coal impurities whatever may be their cause. The mixture is charged progressively according to foundry practice and to the type of the furnace with the object to avoid a stoppage of the furnace and a bubbling around the electrodes.

After about two hours the mixture is completely melted. From the moment the melting has taken place, the walls of the furnace must be the object of great care and attention since they are subjected to be rapidly corroded by the slag, which in this case is very acid and fluid. In this connection care is to be taken that the mixture successively charged is always arranged near the walls of the furnace so that there is in contact with said walls always a cold mixture while the mixture under the electrodes is warm and fluid. When the whole mixture is melted, should any sign of bubbling or ebullition towards the walls or any other symptom of corrosion be perceived, it is necessary to throw against the walls on such points large pieces of dried oxide of calcium.

This phase of the process being a phase of reduction serves to have the greatest possible quantity of silicium passed from the metallic state to the one of oxide, while the passage in a contrary sense is at the same time obtained of as much iron. Said phase may be prolonged advantageously till the metal contains but about the 2% of silicium, after which such a slag is removed. Should the furnace not keep so long the slag, this slag is flown off before reaching the percentage of 2% of silicium. After removing this first slag there is charged

	Kg
Ferric sand	25
Oxide of calcium	25

taking care that a part at least of such calcium is arranged around the furnace, against the walls, under the shape of large clods.

Also this mineral in about an hour and a half is completely melted and kept in the furnace till the metal which is on the bottom has lost the whole silicium after which the metal is flown off, taking care to choose the exact instant in which the metal has lost the silicium and has not been too much oxidised. An eventual oxidation may in any case be remedied as set off further-on.

In the case that after the removal of the first slag a too high percentage of silicium is remained in the metal, for instance the 10%, it certainly happens that the mineral recharged cannot be freed from said percentage. The second slag may then be removed and new material may be charged again for instance 25 kg more. Then the operation may go along similarly, attention being always made to the walls of the furnace, regulating the charge of the three electrodes, or displacing them possibly removing them to a certain distance from the dangerous point on which there is to be placed clods of calcium oxide.

Should the favourable point be surpassed and the metal is oxidised it is then necessary to remove all the slag containing iron oxide and charge oxide of calcium with some flux, for instance fluor-spar capable of keeping the new slag sufficiently liquid notwithstanding the absence of iron oxide together with deoxidising substances.

In order to obtain a good deoxidation it is necessary that the metal remains in the furnace at a temperature of about 1600° C for at least an hour and a half taking care during this period to supply the current but sufficient to keep said temperature so that all the little bubbles being formed in the mass of the metal owing to the deoxidising substances have time enough to ascend and float again, leaving the metal deprived of oxides and inclusions.

The deoxidising substances above mentioned may be aluminium, calcium, magnesium, boron, possibly in alloy even with iron, as also titanium, vanadium and the like. Of course they must not contain impurities especially carbon.

The starting mixture above mentioned is not essential and its composition may vary both according to the concentration of the principal elements contained in the different substances and to the object to be obtained. Also other substances may be added with the object of compensating eventual deficiencies of the substances employed. Instead of silicium iron for instance there may be used aluminium, sodium, magnesium, calcium, carbon, calciumcarbid, calciumsilicid, potassium and so on, mixed or eventually alloyed. There may be also employed a mineral containing other elements besides iron in order to obtain a product containing them in any concentration whatever. This may be particularly applied to the production of alloy steels.

The present invention has been illustrated and described in a preferred form of realisation, but it is clear that constructive changes may be introduced therein practically without surpassing the limits of protection of the present industrial patent.

VINCENZO ARATA.

Published June 1, 1943

Serial No. 283,096

ALIEN PROPERTY CUSTODIAN

APPARATUS FOR CONTROLLING THE FUEL SUPPLY OF INTERNAL COMBUSTION ENGINES

Max Hurst, Hans Helmschrott, and Fritz Hermann, Stuttgart, Germany; vested in the Alien Property Custodian

Application filed July 6, 1939

The invention relates to an apparatus for controlling the fuel supply of internal combustion engines having a fuel delivery control member which, in addition to being actuated by a governor member dependent upon changes of pressure, i. e. pressure measured with respect to atmosphere pressure, in the induction pipe of the engine, is also actuated by a thermostat, in such a manner that an increase in the temperature of the air in the induction pipe results in a reduction of the fuel supply.

In known apparatus of this type the thermostat always adjusts the fuel delivery control member by the same amount for any given change of temperature (such as for example 20°) irrespective of whether the engine is idling and requires only a small amount of fuel or is working at full load and requires a large amount of fuel.

The object of the invention is to overcome this disadvantage and to provide a thermostatic adjustment of fuel supply which has a progressive effect on the fuel delivery control member throughout the different loads of the engine and ranges of pressures existing in the induction pipe respectively.

According to the invention, in an internal combustion engine having a fuel delivery means, a movable member of pneumatic governor is arranged to displace a fuel delivery control member through an intermediate member which is variably coupled to an operating member connected to a movable thermostat member in such a manner that a movement of the operating member, occasioned by a change in temperature, has a progressively smaller effect on the fuel delivery control member as the load of the engine decreases.

The invention will be more particularly described with reference to the following examples with reference to the accompanying drawings in which:

Figure 1 shows a longitudinal section through a governor housing, together with the induction pipe of the internal combustion engine, which is shown on a smaller scale.

Figures 2–4 illustrate the moving parts of Fig. 1 in different positions.

Figure 5 is a section along the line V—V of Fig. 1.

Figure 6 is a graph.

Figures 7 and 8 show another form of construction in different positions.

Figure 9 shows a third form of construction.

Figures 10 and 11 show parts of Fig. 9 on a larger scale and in various positions.

Figure 12 illustrates a fourth form of construction.

Figure 13 is a section along the line 13—13 of Fig. 12.

Part of an injection pump 1 of an internal combustion engine, has a control rod or fuel delivery adjustment member 2 which is connected by means of a connecting rod 3 to a cranked lever 4. The cranked lever 4 is pivotally mounted on a pin 5 attached to a rod 6, which is mounted so as to be axially displaceable in the housing and the right hand end of which is connected to a diaphragm 7. The diaphragm 7 forms a movable partition between two chambers 8 and 9 of a pneumatic governor. One of these chambers 8 communicates through apertures 10 and 11 with the atmosphere whilst the other chamber 9 communicates through a pipe 12 with the induction pipe 13 of the internal combustion engine. The pipe 12 leads into the induction pipe 13 directly behind an adjustable throttle valve 16 in the direction of flow 14 of the air. The throttle valve 16 is contained in a venturi-like constriction 15. When the vacuum rises in the chamber 9, the diaphragm 7, operating as the governor member of the pneumatic governor, moves towards the right whilst when the vacuum decreases, it moves in the opposite direction under the action of a spring 29. In the induction pipe 13 is disposed a thermostat 17, the expanding member of which is connected through the elements 18 and 19 to a lever 20. The lever 20 is fixed to the pivot 21 of a lever 22 which is pivotally mounted on a side wall of the housing as shown in Fig. 5. Into a longitudinal slot 23 of the lever 22 there extends a pin 24 which is disposed on one arm 25 of the cranked lever 4, which is shown in the horizontal position in Fig. 1.

When the lowest temperature prevails in the induction pipe 13 of the engine, for example at −20° C the thermostat 17 stands in the position shown in Fig. 1, in which case the lever 22 and the slot 23 are horizontal. Under these conditions, when the throttle valve 16 remains in the idling position as shown in Fig. 1, the high degree of vacuum prevailing behind the throttle valve, and consequently, also in the chamber 9 causes the parts of the apparatus to move into the position shown in Fig. 1. If the vacuum increases still more, for example in an over-run, the pin 24 can be moved still further towards the right in Fig. 1 until its axis coincides with that of the fulcrum 21 of the lever 22, when the gov-

ernor rod 2 comes into its stop position whilst the connecting pin 26 stands in the position a and the injection pump supplies no fuel. If the same minimum temperature is maintained in the induction pipe whilst the throttle valve is opened, that is adjusted to the full load position, then a comparatively low degree of vacuum prevails in the chamber 9, right up to the maximum engine speed. The spring 29 is thus able to move the diaphragm 7 and the other moving parts into the position shown in Fig. 3, in which position the injection pump is adjusted to give full load fuel supply. Under these conditions the connecting pin 26 reaches the position b.

This manner of operation which applies to minimum temperatures is changed when the temperature rises. When, at a temperature of +30° C for example, the lever 20 is moved by the thermostat 17 into the position shown in Figs. 2 and 4 then the change of pressure in the chamber 9 causes the pin 24 to slide in the slot 23 which is now in a diagonal position. Under these conditions the displacement of the diaphragm 7 forces the cranked lever 4 to turn about the pivot 5 (when the slot is in the horizontal position shown in Figs. 1 and 3, the cranked lever 4 is simply displaced horizontally without at the same time turning about the pivot 5). When the temperature rises above −20° for example, the free end of the lever arm 22 which is shown in Figs. 2 and 4 inclined downwards, at one temperature, now turns the angular lever 4 towards the left, in an anti-clockwise direction, as a consequence of the movement of the diaphragm 7. This movement produces a displacement of the governor rod 2 towards the right, thus reducing the fuel supply. This displacement of the governor rod to the right, as a result of rising temperature, always remains less than the simultaneous displacement of the diaphragm 7 towards the left, so that every displacement of the diaphragm towards the left, as a result of a decrease of vacuum in the chamber 7, is accompanied by a movement of the governor rod towards the left, which movement merely decreases in relation to equal changes of vacuum and equal adjusting movements of the diaphragm, on account of the increasing slope of the slot 23, that is of the increasing temperature. Whilst, for example at −20° a displacement of the diaphragm 7 or of the pin 5 connected thereto from the stop position a into the full load position b as shown in Fig. 3 would correspond to a displacement of the governor rod through the distance x, yet at +30° an equally large displacement of the diaphragm 7 and of the pin 5 of the governor rod, would in the position shown in Fig. 4, result in displacement only through the distance y, which is smaller than the distance x by the distance z.

This reduction of the displacement by the distance z which applies to variations of loading between zero and full load and to the temperature variation of 50°, between −20° and +30°, does not remain constantly uniform for the same temperature variations, but changes according to the amount of load. For example, when the engine is idling, if the diaphragm 7 moves so that the pin 5 is displaced from the stop position a into the idling position d shown in Figs. 1 and 2, thus moving through the distance x_1, then the governor rod at −20° moves through the distance x_1 as shown in Fig. 1, whilst at +30° according to Fig. 2, the governor rod moves through the distance y_1 which varies from x_1 only by the negligible amount z_1. In the partial load position shown in dotted lines in Fig. 2, the corresponding distances x_2 and y_2 differ rather more, namely by the amount z_2. It will be seen that the same change of temperature produces a movement towards the right which increases with increase of engine load. Therefore, when the engine is heavily loaded and is receiving a large amount of air, whilst rises of temperature considerably decrease the weight of the inducted air, then the fuel supply is reduced accordingly, whilst if the engine is idling and the air and fuel supplies are small, then the fuel supply is reduced by only a small amount. Under these conditions therefore the lever 22 is a control member dependent upon the thermostat and inserted in the rod between the diaphragm 7 and the governor rod and engaging with the pin 24, in such a manner that the movement of the governor rod depends increasingly upon the temperature influences as the engine load increases. In the example described the relations are such that $x{:}z=x_1{:}z_1=x_2{:}z_2$ etc.

Fig. 6 is a graph showing this relation, of which the abscissa indicates the engine load whilst the ordinate indicates the fuel supplied by the injection pump. The line m represents the increase of fuel required by the engine and of the fuel supplied by the injection pump as the load increases, at the minimum temperature (example −20°) of the inducted air, corresponding to the increased air supply required through increasing loading in mixed fuel engines with foreign ignition. The lines n, o, p, q, r indicate smaller fuel supplies such as are required when less air passes into the cylinder as a result of increase in the temperature of the inducted air and which are obtained according to the present invention by means of the various diagonal positions of the slot 23. The dotted line t merely indicates that it would be incorrect to arrange the thermostat so that the fuel supply is always reduced by the same amount w, or alternatively so that the governor rod is always displaced through the same distance for any given change of temperature, irrespectively of the prevailing engine load, or alternatively of the amount of air in the cylinder. In this case, at high temperatures under idling and partial load conditions, the governor rod would be displaced too far in the stop direction, whilst at full load the displacement would not be sufficient. This arrangement might at most be possible in engines which are constantly run at full load.

The slot 23 in the lever 22 may naturally also be curved if this is desirable for some particular purpose, such as for example producing a richer mixture under idling and partial load conditions.

Figs. 7 and 8 show another example of construction of the invention. A two-armed lever 30, 31 is connected by means of a slot 32 in one of its arms 30 to a pin 33 attached to the governor rod 34 of the injection pump, whilst a slot 36 in the other arm 31 connects the lever with a pin 39 disposed on a rod 38 leading to the diaphragm 37 on a pneumatic governor. The two armed lever 30, 31 is mounted on a pivot 40 fixed to a guide element 41 which slides in a slot 42 in the housing. The guide element 41 is displaceable by means of a lever 43 mounted on a pivot 44 in the housing and engages by means of a slot 45 with the pin 40. To the right of the pivot 44 in Figs. 7 and 8 the lever 43 is connected to a rod 47 leading to a thermostat 46. When the temperature rises in the induction pipe, the rod 47 is displaced in the upward direction by the ther-

mostat **46**, thus causing the lever **43** to be rotated in an anti-clockwise direction. As a result the guide element **41** is displaced in the downwards direction in the slot **42** of the housing and carries with it the lever **30**, **31**, into the position shown in Fig. 8 for example.

Fig. 7 shows the lever **43** in a position corresponding to the lowest temperature allowed for (e. g. —30° C). When a low degree of vacuum prevails in the governor chamber **48**, the diaphragm **37** and the lever **30**, **31** are in the position shown in full lines, in which position the governor rod **34** is adjusted to the highest fuel supply required at full load. In the position v shown in dotted lines, the pins **39** and **33** stand at **39'** and **33'** and the governor rod **34** is adjusted to the stop position. The operative lever arms f and g of the two-armed lever **31** are of equal length as shown in Fig. 7. Consequently, when the diaphragm **37** or the pin **39** are displaced by the amount h, then the pin **33** or the governor rod **34** are displaced by an equal amount h_u.

On the other hand, when a higher temperature prevails in the induction pipe and the lever **43** stands in the position shown in Fig. 8, in which case the lever ratio $f:g$ shown in Fig. 7 is changed to the ratio $f':g'$ shown in Fig. 8, then the same displacement h of the pin **39**, which moves with the diaphragm **37**, into the position **39'** produces a displacement of the pin **33** only by the amount h'. Thus it will be seen that at a higher temperature and at full load the governor rod **34** is displaced from the stop position by an amount which is less by the amount i' in Fig. 8 than the displacement taking place at the lowest temperature, and at the same full load adjustment. This distance i' changes with every variation of the engine load, while lever ratio $f':g'$ and the variation from minimum temperature both remain constant. For example the distance i' changes to i', t when the pin **39** moves from the position of no fuel supply **39'** into the partial load position h, t of the lever **31**, shown in dotted lines. Given the same temperature changes, this variation is proportional to the change of engine load, or alternatively to the degree of vacuum prevailing in the governor chamber, which in turn depends upon the volume of air flowing into the cylinder through the induction pipe. What is true for the lever ratio $f':g'$ is also true when this ratio changes as a result of a change of temperature in the inducted air, and in fact it is always true that the influence of a rise in temperature on the reduction of fuel supply is proportional to the degree of engine load and consequently to the weight of air passing into the engine at each piston stroke.

In a third form of construction shown in Fig. 9 a roller **52** attached to a governor or rod **50** of a benzol injection pump **51** is pressed by a weak spring **54** against one side of a cam shaped member **53**. The other side of the cam engages with a second roller **55** which is mounted on the right hand end of the longitudinally displaceable rod **56**. The left hand end of the rod **56** is connected to a two-armed lever **57**, **58**, which is mounted on a pivot **60** on the left hand end, of a rod **59**, the lower end of which two armed lever is connected by a pin **61** to a rod **62**. The rod **62** is connected to the governor diaphragm **63**. From one chamber **64** of the governor, a duct **66** leads to the induction pipe **67** of the engine into which it opens at a point behind an adjustable throttle valve **69** in the direction of flow of the air **68**, the other governor chamber **65** communicates through apertures **70** and **71** in the housing with a space which is maintained at a pressure equal to that in the induction pipe outside the throttle valve **69**, that is, in the present example, which is designed for self inducting engines, the atmosphere. The diaphragm box **72** is also exposed to the pressure prevailing in front of the throttle valve, which box expands as soon as the engine of a vehicle is exposed to a low air pressure, for example at high altitudes. This expansion of the diaphragm box **72** causes the pin **60** of the lever **57**, **58** to swing towards the left about the point **61**, thus causing the cam **53** which is pivoted on an eccentric **73** to displace the governor rod **50** towards the left into the stop position. The governor rod is similarly moved in the same direction when the vacuum increases in the chamber **64**, as a result of an increase of engine load, thus causing the diaphragm **63** and the lower pivot **61** of the lever **57**, **58** to be drawn towards the right.

The eccentric **73** is rotatable about the pin **75** which is locally fixed in an arm **74** of the injection pump **51**. To the pin **75** is connected a lever **76** which is connected by a rod **77** to a thermostat **78** arranged within the induction pipe **67**. When the temperature rises in the induction pipe **67**, the rod **77** is moved towards the left in Fig. 9, with the result that the eccentric **73** is angularly displaced by means of the lever **76** and the cam **53** moves in the downward direction. With reference to Figs. 10 and 11, which show enlarged views of the cam **53**, it will be explained how, under various engine load conditions, the changes of temperature in the induction pipe, acting through the thermostat, the eccentric and the cam, affect the position of the governor rod and consequently the supply of fuel through the injection pump.

In Fig. 10 the governor rod **50** and the rod **56** connected to the governor, stand in the stop position, in which position the injection pump is adjusted so as to supply no fuel. When the eccentric **73** is rotated by the thermostat **78** out of the position shown in full lines, corresponding to the minimum temperature, into a position **73**a shown in dotted lines, corresponding to a higher temperature, then the cam moves in the downward direction without causing any movement of the governor rod **50**. Therefore in the stop position changes of temperature have no effect on the position of the governor rod.

However conditions are different when the engine is loaded and the injection pump, as shown in Fig. 11, is adjusted to give a large fuel supply under full load conditions. The position **50**a of the governor rod corresponds to the position of the eccentric **73** at the minimum temperature, for example —20°, and with the diaphragm **63** standing in the full load position. With the diaphragm **63** in this full load condition an increase in temperature causes the eccentric **73** to move into the position **73**a shown in dotted lines, so that the left hand side of the cam **53** slides on the roller **55**, whilst the right hand side of the cam allows the governor rod to move into the position **50**b, thus supplying a smaller amount of fuel at full load to correspond to the higher temperature. In the same manner, when the diaphragm **63** is adjusted for partial load, the cam **53** causes the fuel supply to be progressively reduced as the cam descends from its topmost position. However, at partial load, the influence of a change of temperature of for example 20° is less than at full load. It will be seen that in

this case also, temperature changes exert progressively less influence on the fuel supply as the engine load rises.

In a fourth form of construction shown in Fig. 12, the control rod of the governor is connected by means of a rod **60** to an eye **61** of a ring **62**. The ring **62** fits closely by means of a flange **63** on its inner periphery around a piston **64** of a servomotor and contains an operating slide **65** which also fits closely around the piston **64**. On the side of the ring remote from the internal flange **63** is fitted a cover **66** which prevents longitudinal displacement of the operating slide **65** within the ring **62**.

The operating slide **65** is provided with two operating abutments **67** and **68** which rest against the outer periphery of the piston **64**. A space **69** between the operating edges **67**, **68** communicates through ducts **71** and **72** in the piston, (indicated by dotted lines in the drawing), with an oil inlet pipe which is not shown. Moreover, operating grooves **73** and **74** are provided in the outer periphery of the piston. The left hand groove **73** communicates through two ducts **75**, **76** in the piston **64** with a space **77** to the right of the piston, whilst the right hand groove **74** communicates through ducts **78** and **79** with a space **80** on the left hand side of the piston. A rod **81** connects the piston **64** to the control rod of an injection pump, the two latter not being shown in the drawing.

It is to be understood that the governor connected to the rod **60** moves the operating slide **65** towards the right in Fig. **12** as the engine load increases. This movement forces oil out of the space **69** through the groove **74** and the ducts **78**, **79** into the space **80**. Consequently the piston **64** follows the operating slide **65** towards the right until the operating surfaces **67**, **68** again cover the grooves **73**, **74**. A state of equilibrium is then established in the new position. The oil forced out of the space **77** by the movement of the piston towards the right, flows through the ducts **76**, **75**, the groove **73**, the space to the left of **67** and ducts **82**. This movement towards the right carries the rod **81** towards the right and adjusts the governor rod of the injection pump so as to give a larger fuel supply corresponding to the increased engine load.

In the case of a decrease in engine load the rod **60** moves the operating slide **65** towards the left, forcing oil from the space **69** through the groove **73** and the ducts **75**, **75** into the space **77**. In this case the piston **64** follows the movement of the operating slide towards the left, adjusts the control rod so as to give a smaller fuel supply and forces the oil from the space **80**, through the ducts **79**, **78**, **74**, through the space in the operating slide **65** to the right of the operating edge **68**, and through ducts **83**.

The operating slide **65** is also provided with a pin **90** which passes through a slot **91** extending round part of the circumference of the ring **62**. The pin **90** is pivotally connected to a second pin **92** which slides in a barrel **93** which is loosely disposed in a slot **94** of a lever **95**. The lever **95** is fixed to one end of a spindle **97** which is rotatably disposed in the servomotor casing, whilst the other end of the spindle carries a lever **98** which is connected to the thermostat. In the present example as shown in the drawing, the connection of the thermostat to the lever **98** is such that at the lowest temperature of the inducted air, the slot **94** of the lever **95** is parallel to the axis of the piston **64**. In the partial load position as shown in the drawing, the slide **65** is disposed so that the pin **92** stands approximately in the middle of the slot **94**. However, if the slide **65** is adjusted to the position of no fuel supply, then the pin **92** stands at the left hand end of the slot **94**, so that the axis of the pin **92** coincides with the axis **97***a* of the spindle **97**. In the position of no fuel supply, when the axes coincide in this manner, angular displacement of the levers **98** and **95** have no effect on the pins **90** and **92**. However, if the operating slide **65** stands in the middle or partial load position, shown in the drawing, then any rotary movement of the lever **98** causes the pin **92** to be moved out of the plane of the drawing, carrying with it the pin **90** and thus causing angular displacement of the operating slide **65** relatively to the piston **64**.

In the partial load position as shown, the operating edges **67**, **68** and the grooves **73**, **74** extend forwardly and rearwardly out of the plane of the drawing and have the shape of spiral lines. When on a rise of temperature, the lever **95** is moved forward out of the plane of the drawing from its position parallel to the axis of the piston, then as the upper half of the operating slide **65** moves forward and the lower half backwards, the operating edges **67**, **68** are displaced towards the right relatively to the grooves **73**, **74**. With the spiral grooves **73**, **74** directed as shown in the drawing, the result of this movement is that the space **69** comes into communication with the duct **75** opening into the groove **73** and consequently with the space **77**, so that the governor rod is adjusted so as to reduce the fuel supply. A further reduction of fuel supply at the same temperature, and consequently with the levers **98** and **95** adjusted to the same position, is produced when at high engine load the slide **65** stands further towards the right in Fig. 12 and is consequently still further angularly displaced by the pin **92** sliding in the spiral slot **94**. This naturally causes the piston **64** and the governor rod **81** to be displaced further towards the left. Therefore the movement of the governor rod in a direction producing a decrease of fuel supply for any given rise of temperature varies directly with the engine load, that is with the influence exerted by the rise of temperature upon the weight of air supply to the engine.

The invention may be applied to supercharged engines in addition to self inducted engines.

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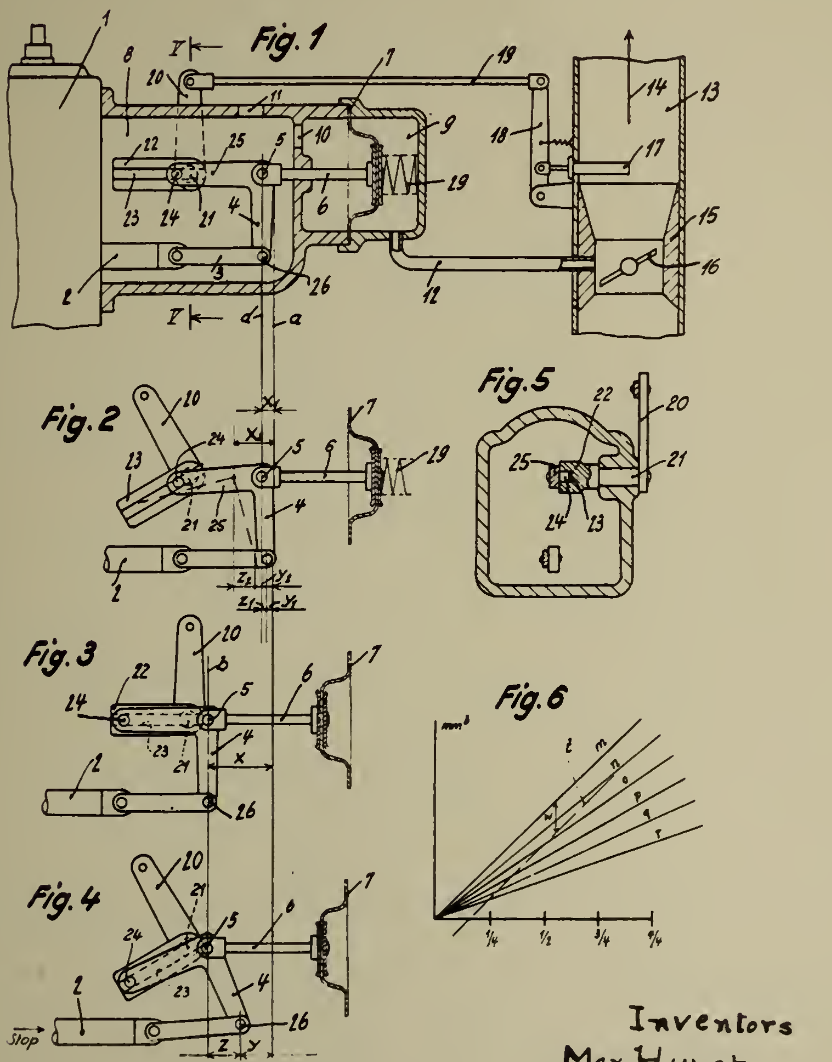
4 Sheets-Sheet 1



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4 Sheets-Sheet 2

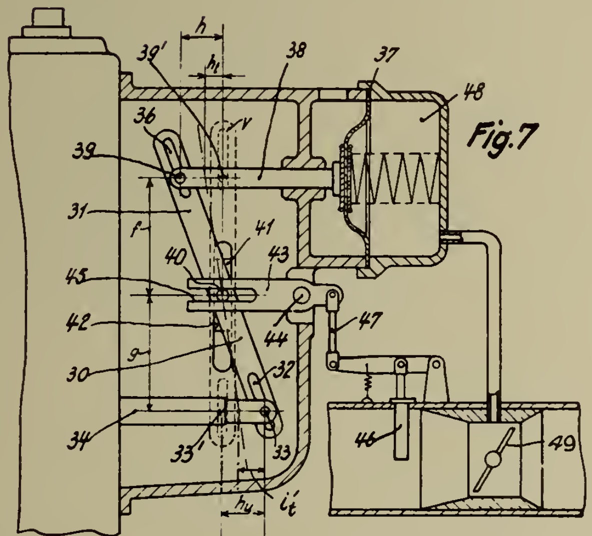

Fig. 7

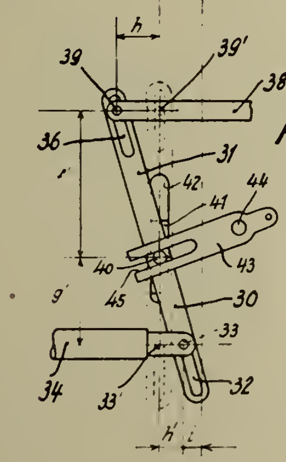

Fig. 8

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Fig. 9

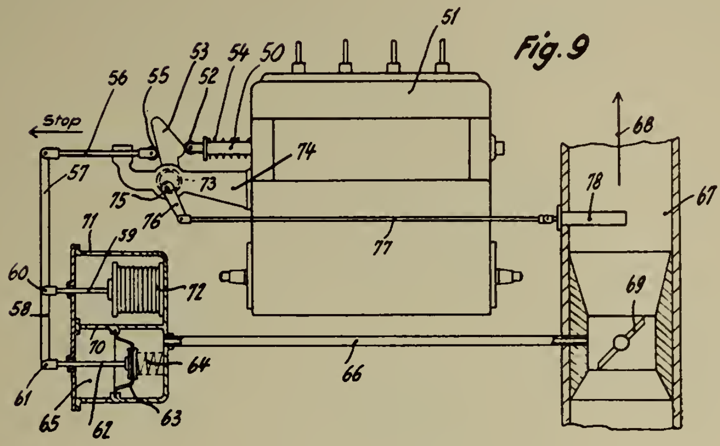

Fig. 10

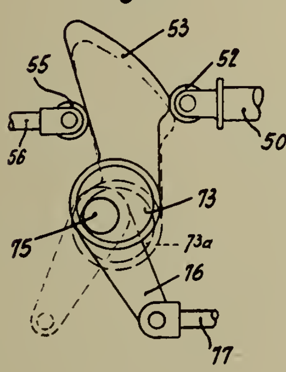

Fig. 11

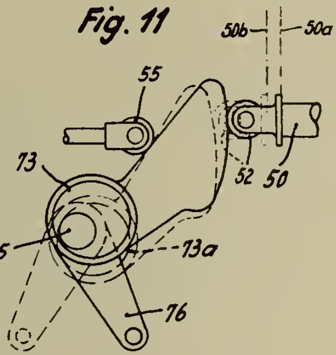

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Fig. 12

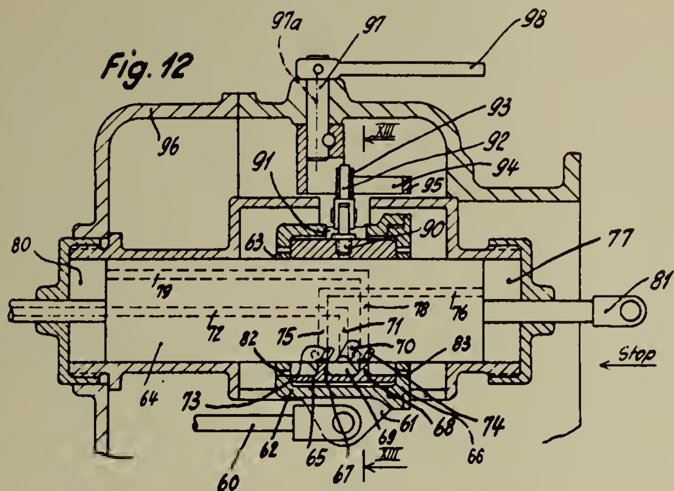
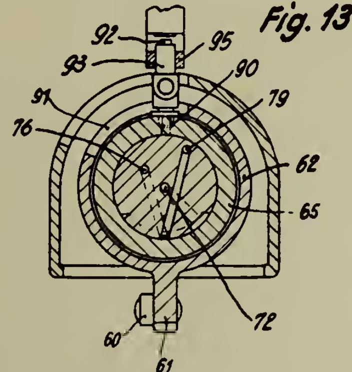


Fig. 13



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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE MANUFACTURE OF AN IMPROVING AGENT FOR THE BAKING QUALITY OF FLOUR

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No Drawing. Application filed July 19, 1939

The present invention relates to a process for the manufacture of an agent for improving the baking quality of flour, and consisting more particularly of ascorbic acid in admixture with substances having an activating influence on the action of the ascorbic acid. Substances may also be incorporated to obtain more stable mixtures which are suitable for addition to flour and other meal and milling products by means of mechanical apparatuses.

The action on the baking properties of flour and meal and milling products of ascorbic acid or of compounds containing the ascorbic acid radical or of compounds from which ascorbic acid is readily formed, is described in the United States Patent Specification No. 2,149,682. In this specification it is also set out that very small quantities of ascorbic acid are usually sufficient for the desired action so that for example quantities of the order of 0.0002–0.0005% by weight of the flour are suitable. Furthermore it is at present generally accepted that ascorbic acid and vitamin C are identical.

In the United States Patent Application No. 164,989 methods are described for making stable mixtures comprising ascorbic acid by mixing it with solid sub-divided non-hygroscopic substances. In this way mixtures may be obtained which are stable to moisture and to oxidation.

Now it has been found that the improving action on the baking strength of flour of ascorbic acid, the compounds containing the ascorbic acid radical, and the compounds from which ascorbic acid is readily formed, may be increased by adding to these substances a very small quantity of an activator, which may possibly be regarded as a catalyst. As substances capable of activating or catalyzing the action of ascorbic acid mention may first be made of very small quantities of finely divided heavy metals or their compounds, such as copper, manganese, cobalt and iron, and further especially copper-, manganese-, cobalt- and iron proteins or proteic acid salts of copper, manganese, cobalt and iron, which may be obtained both from natural sources and synthetically. The common salts of the above mentioned heavy metals may be used advantageously because they are easily brought into a finely divided state. Selfevidently, mixtures of the activating agents can be used. Also it has been found that dried powder derived from several vegetables and fruits such as "Hubbard Squash" (Cucurbita maxima), Klentang (Moringa pterygosperma), cucumbers, cabbage leaves and tomatoes, may be used according to the invention. The above mentioned activating catalysts are added to ascorbic acid in a quantity depending on their nature and on the desired action on ascorbic acid. The pure activating catalyst is added in a smaller quantity of e. g. 0.0000001–10% by weight than the natural fruit powders containing this catalyst. They are preferably added in an amount such as occurs in natural sources of vitamin-C so that a mixture may be obtained in which the proportion of the activating agent to vitamin-C is approximately equal to that occurring in these natural sources of ascorbic acid.

By adding the activating substances as identified above, the amount of ascorbic acid required for a given improvement of the baking strength of flour is about half the quantity of ascorbic acid required if used alone, so a considerable saving of the improving agent may be obtained.

It is self-evident that according to the present invention an improved baking quality of the flour may also be obtained by mixing first the ascorbic acid with the flour or the dough prepared therefrom and thereafter adding a small quantity of the activating agent or by adding first the activating agent and thereafter the ascorbic acid to the flour. However, preferably the substances should be mixed intimately with the ascorbic acid, if desired in admixture with some indifferent substances according to United States Patent Application No. 164,989.

Also the invention includes the addition of activating agents to fruit juices or other vegetable preparations containing ascorbic acid if the quantity of the activating agents already present in such juices or preparations is not sufficient, and the application of such treated juices to baking. In this case it is not necessary to add the dried powder of the vegetables or fruits containing the activating substances to the preparations, which are relatively rich in ascorbic acid, but instead the juice pressed from vegetables and fruits may be employed.

The following specific examples may serve to illustrate methods of carrying out the invention in practice. It may be understood that these examples are not limitative.

Example I

A solution in water containing 1% by weight of gelatin is cooked with a small amount of copper hydroxide and is thereafter filtered, giving a solution of copper-proteinate having a copper content of about 25 mg./litre. This solution is thoroughly distributed over some starch in such a way that after drying a mixture is obtained which contains

0.01% of copper in active form. To 0.75 gr. of this mixture 0.75 gr. ascorbic acid and 98.5 gr. of maize starch are added and the whole is intimately mixed. This preparation has an active copper content of 0.000075%. These 100 grams of treating agent are added to 100 Kg. of flour and loaves are baked in the usual way from 450 gr. of flour per loaf. The volume of a loaf of untreated flour is 2310 ccs. whereas a loaf baked from the treated flour has a volume of 2635 ccs., which is an improvement in volume of 14%. The same flour treated with ascorbic acid in a quantity of 1.5 gr./100 Kg., i. e. double the amount used above, gives a bread of a volume of 2565 ccs., i. e. an improvement in volume of 11%.

Example II

The fruits of kelor (moringa pterygosperma) are dried in vacuum at low temperature after being comminuted. In this way a dry mass is obtained which may be converted to a finely divided dry powder. An improving agent for the baking quality of flour and other meal and milling products may be prepared by adding 5% of this fruit powder to 1% ascorbic acid, 30% wheat starch and 64% dicalcium phosphate. For the treatment of flour 60 grams of this powder are equivalent to 100 grams of the same agent without fruit powder, when added to 100 Kg. of flour.

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ALIEN PROPERTY CUSTODIAN

INDICATING MEANS, AND MORE PARTICULARLY TO MEANS FOR INDICATING THE NUMBER OF ROUNDS OF AMMUNITION FIRED FROM OR AVAILABLE TO A GUN

Erich Nöthe, Berlin-Spandau, and Otto Siepke, Berlin-Staaken, Germany; vested in the Alien Property Custodian

Application filed July 21, 1939

This invention relates to indicating means, and more particularly to means for indicating the number of rounds of ammunition fired from or available to a gun.

One of the objects of the present invention is to provide novel means for indicating to a gunner the number of rounds of ammunition available to a gun located at a point remote from the gunner.

Another object is to provide a novel indicator of the above character which is light in weight, small, requires a small amount of energy for actuation, and therefore is especially adapted for use in aircraft.

A further object is to provide a novel indicator of the above character which is dependable in operation, and which can be read rapidly and accurately.

The above and further objects and novel features will more fully appear from the detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for purposes of illustration only and are not intended as a definition of the limits of the invention, reference being had for this latter purpose to the appended claims.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a side elevation, partly in section, of one embodiment of the invention; and,

Fig. 2 is a front elevation of the embodiment of Fig. 1.

The form of the invention illustrated in the accompanying drawings, by way of example, comprises means for indicating the number of rounds of ammunition which have been fired from a gun and hence means for indicating the number of rounds which remain available to the gun. The indicating means includes a rotatable drum having curved indicia thereon which can be read against a suitable scale. Means are provided for advancing the drum step-by-step in predetermined angular increments, each angular advancement being in response to a firing of a remotely located gun.

As shown in Fig. 1, the novel device is constituted by a drum **10** having curved indicia **11** thereon which, for example, comprises a helix marked upon the cylindrical surface of the drum. The drum is rotatably mounted in a housing **12** upon a shaft **13**, the housing having a slot **12***a* therein through which a portion of the drum is visible together with a fixed scale **14** against which the curve **11** can be read.

In order that the drum can be angularly advanced in predetermined angular increments, each of which corresponds to a separate actuation of the device as produced, for example, by each firing of a round of ammunition from a machine gun **15**, a suitable step-by-step advancing system **16** is provided which may, for instance, comprise a ratchet and pawl mechanism (not shown).

Means for operatively interconnecting the gun **15** and the rotatable drum are provided comprising an intermittently operable switch **17** which controls an electric circuit, the switch being closed by the gun, for example, when the lock or bolt thereof is in a "ready" position for firing. Switch **17** governs the flow of current to an electro-magnet **18** which has an armature **19**. The latter is operatively connected to the step-by-step system in such a manner that the drum is advanced by a predetermined angular amount each time the electro-magnet is energized.

Manually operable means for adjusting the drum to an initial or zero position are provided comprising a knurled knob **20** upon a shaft **21**, the latter having a bevel gear **22** thereon which is in mesh with a bevel gear **23** upon the shaft **13**. A suitable friction clutch (not shown) is interposed, for example, between member **16** and drum **10** in order that the drum may be manually turned with reference to the remainder of the device.

The embodiment illustrated is provided with a plug connection **24** in the electric leads interconnecting elements **17** and **18**, which enables the inserting of housing **12** into a master container **25** without the necessity for screw connections. This invention is primarily for aircraft, and since there are, ordinarily, several machine guns on board such craft, there should be provided an indicator for each gun. These indicators can be easily mounted in a common housing. In the event that one indicator becomes inoperative or defective, it is only necessary to withdraw it from the housing and to replace it by another which is at once ready for operation.

In operation, the intermittent closing of the switch **17** by the gun **15** intermittently energizes electro-magnet **18** which in turn moves the drum a predtermined amount for each energization thereof by means of the step-by-step system. Thus the curve **11** moves relative to scale **14** and indicates the number of rounds fired or the number available to the gun.

There is thus provided a novel indicator which, due to the small size, light weight, and compact-

ness thereof, is especially adapted for being mounted upon the instrument panel of an aircraft.

Although only one embodiment of the present invention has been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. For example, the indicator is not confined to use with guns but may be employed with other devices which require indications of the number of intermittent actuations thereof. Various changes may be made in the design and arrangement of the parts without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art.

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OTTO SIEPKE.

PUBLISHED

JUNE 1, 1943.

BY A. P. C.

E. NÖTHE

INDICATING MEANS, AND MORE PARTICULARLY TO MEANS FOR INDICATING THE NUMBER OF ROUNDS OF AMMUNITION FIRED FROM OR AVAILABLE TO A GUN

Filed July 21, 1939

Serial No. 285,810

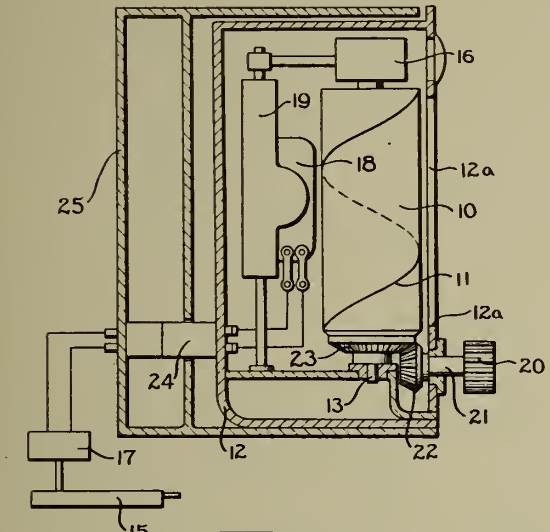

Fig 1

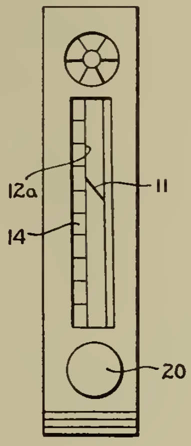

Fig 2

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BY Stephen Czerwik
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Published June 1, 1943

Serial No. 286,279

ALIEN PROPERTY CUSTODIAN

ILLUMINATING SHELLS

Jean Wauters, Bruxelles, Belgium; vested in the Alien Property Custodian

Application filed July 24, 1939

The usually illuminating shell generally comprises a cylindrical body within which are housed, from front to rear, the parachute, the flare slab and the ejecting charge.

When said shells are fired from smooth bore mortars, propulsion is often obtained by means of a cartridge introduced into a tubular rear stem provided with radial perforations permanently attached to the base of the shell. When the charge has been fired, the cartridge case, which has burst opposite the perforations in the stem, is powerfully pressed against the latter by the pressure of the gases and is drawn along by the shell thus leaving the barrel free for the next shot.

The objection raised against these devices is the insufficiency of their range due to their outline which is unfavourable to travel through the air. They whirl about themselves and, in practice, barely exceed a height of a few hundred yards.

The object of the present invention is to provide a projectile which, other things being equal, will travel distinctly higher or further.

It is particularly remarkable owing to the fact that it is provided with a vaned body the tapering nose and tail of which are connected by a cylindrical intermediate portion arranged so as to open under the action of the ejecting charge behind which the flare slab is housed, while the parachute is mounted at the rear of the latter and occupies a fraction of the tapering rear portion.

This arrangement provides a judicious distribution of the masses in the projectile and is conducive to its stability. As the parachute which is very light (it is usually made of silk) is placed at the rear of the projectile, the centre of gravity of the projectile is thereby set further forward.

According to a further feature of the invention, the body of the projectile is composed of a cone shaped base to the front of which is fixed a cylindrical collar which is itself capped by the rear portion of a cylindrical stamping the front end of which ends in a concavo-convex head the concave front end of which merges tangentially into the adjoining convex portion. This arrangement ensures the correct opening up of the projectile when it functions and the ready release of the flare and parachute which it contains.

A further feature of the invention lies in the fact that, at the rear, the slab rests on the front edge of said cylindrical collar. Said slab merely bears by inertia on said collar at the moment of firing and cannot therefore compress the parachute.

Other advantages and peculiarities of the invention will appear in the following description.

In the attached drawing which is given merely as an example,

Figure 1 is an axial section of an illuminating shell according to the invention;

Figure 2 is a view from the rear;

Figure 3 shows the flare slab suspended from the parachute;

Figure 4 is an axial section of another embodiment of the invention;

Figure 5 is a side view of the elements forming the parachute receiver.

In said drawing, 1 is the substantially conical base of the projectile to which stabilising vanes 2 are welded (by means of clamps 1*a*) or otherwise secured. To the base is fixed a cylindrical collar 3 capped by the rear portion of a stamping 4, which is cylindrical along a certain portion of its height, and which is terminated in front by a concavo-convex surface of revolution, the forward concave portion 5 merging with the adjoining convex portion 6 by a point of change of curve.

The concavo-convex portion of the stamping surrounds a hollow head, of corresponding outer shape, into which any type of time fuse may be screwed. Beneath fuse 8 is an explosive or ejecting charge 9 which itself tops flare slab 10 with which it communicates through a channel 11 drilled through container 12 of the slab. Matches 13 facilitate the ignition of the flare slab 10 attached to parachute 14 by suspending ropes 15 and a cable 16.

Parachute 14, suitably folded, is housed at least partially in the base 1, at the rear of slab 10 which rests on the front edge of collar 3.

A driving band 17, capable of distorsion and housed in groove 18*a* of collar 3, is intended to ensure leakproofness between the projectile and the smooth bore of the gun.

Stamping 4 is preferably secured to collar 3 by a few punch marks 18 hammered into said stamping in line with a groove 19 in the collar.

The flare slab 10 is retained against movement in the shell by being interposed between the under edge of the head 7 and the upper edge of the collar 3.

In the present example, propulsion is obtained by means of a cartridge 20 housed in tubular stem 21 radially perforated at points 22 and removably fitted to the rear of the projectile. The

tail stem is secured by the friction of its flange **23** on the inner edge of vanes **2** in the manner described in my co-pending Patent Application Serial No. filed on the same date as the present application and entitled: "Improvements in vaned projectiles."

Operation is as follows:

Cartridge **20** having been fired, the gases from the gunpowder escape through perforations **22** thus propelling the projectile. Tail stem **21** becomes detached and is expelled by the effect of the blast after the projectile has itself emerged from the tube, as explained in the afore-mentioned co-pending application. Driving band **17** is propelled by the gases between the projectile and the tube and ensures leak-proofness. Slab **10**, which rests on collar **3**, cannot compress the parachute owing to the effect of inertia developed on firing.

After a period of time determined by the setting of time fuse **3**, the latter fires ejecting charge **9** which deflagrates in head **7** and ejects slab **10** from stamping **4**, which becomes detached from collar **3**. Parachute **14**, drawn along by slab **10**, emerges from its housing and opens out as shown in Fig. 3. Slab **10**, ignited by matches **13**, then burns and provides the desired illumination.

Instead of tail stem **21** being fitted loose, it might be permanently fixed to the projectile. Nevertheless, the detachable tail stem making the rear lighter improves the stability and therefore contributes to a greater range. The thickness of head **7** necessitated by the fact that it has to resist the pressure of the ejection charge also offers the advantage of bringing the center of gravity further forward.

In the embodiment of the invention shown in Fig. 4 where the same reference numbers relate to the same parts as on Fig. 1, the parachute **14** is lodged in a receiver or case **24** having the shape of a tumbler the sides of which widen slightly from rear to front. The receiver **24** is made up of a plurality of elements **24*a*** (Fig. 5) which separates from each other when the shell opens under the action of the explosive charge or booster **8*a***.

A spring **25** bearing, at one end, against the internal bottom of the base **1**, and, at the other end, against the bottom of the receiver **24**, is used to expel the receiver and the parachute out of the shell when the same is burst by the explosive charge **8*a***. The spring **25** is centered along the axis of the shell by a block **28**, which may be made of wood or some other relatively light material.

The spring **25** is positioned in an axial hole of the block **28** as shown in Fig. 4.

The black **28**, preferably, corresponds in shape to the internal walls of the base **1** and is stuck or otherwise fixed thereto. It acts as a rearward bearing for the receiver **24**.

The rear end of the spring **25** is attached to a teat **27** fixed in the bottom of the base **1**.

In the embodiment of Fig. 4 the stem **21** carrying the propulsive cartridge is fixed to the shell, and the vanes **2** are fixed to the rear part of the stem, so that a space is left free in the front of the vanes to place the additional propulsive charges shaped by example as a horse shoe.

The forward part of the stamping **4** is entirely convex. That stamping is fixed, at the rear, to the ogival base of the shell with screws **29**. The connection is calculated to yield under the pressure of the gases developed by the booster **8*a*** when fired by the fuse **8**.

It will be understood that the invention has been illustrated and described merely as an example and that it is capable of variation and modification without departing from the spirit of the invention.

JEAN WAUTERS.

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J. WAUTERS
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2 Sheets-Sheet 1

Fig. 1

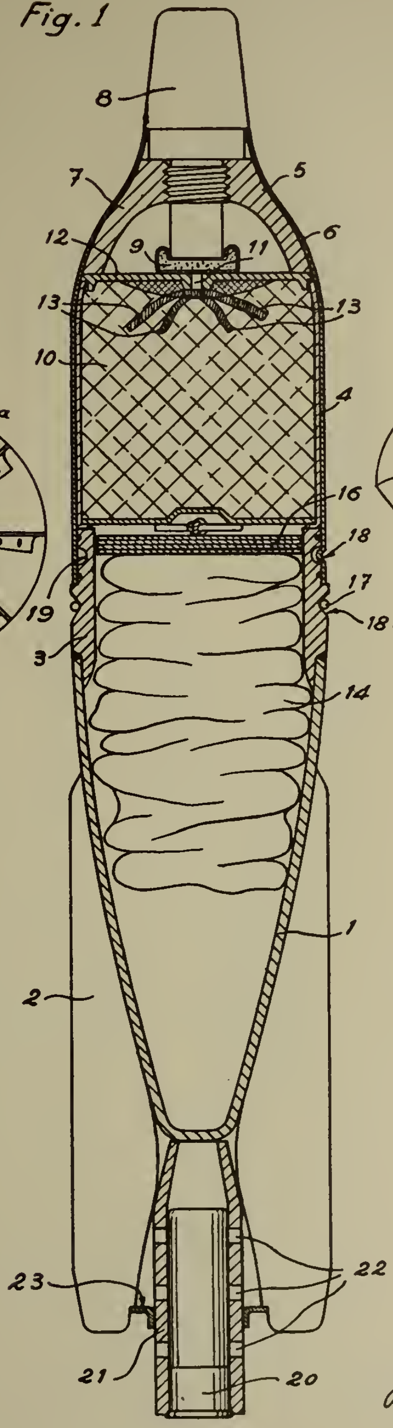

Fig. 2

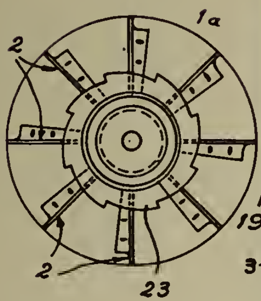

Fig. 3

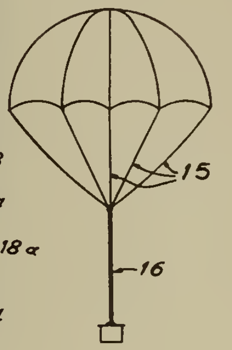

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Fig. 4

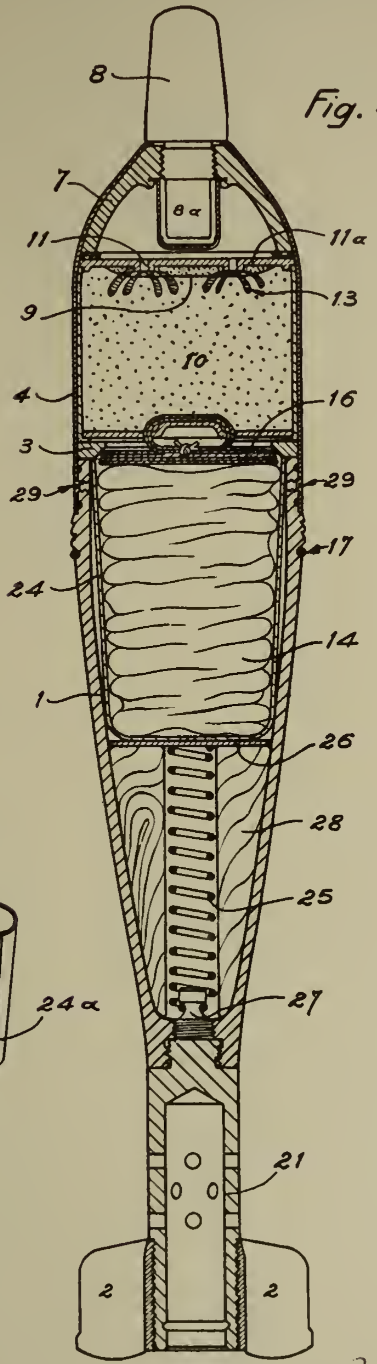
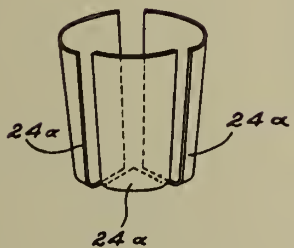


Fig. 5



Inventor:
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ALIEN PROPERTY CUSTODIAN

MULTIPLE DIVERGENCE REFLECTING DEVICES

André Garbarini, Courbevoie, France; vested in the Alien Property Custodian

Application filed August 9, 1939

The present invention relates to self-collimating devices as are chiefly used for making visible road signalling or advertising apparatus when the light rays emitted by the headlights of a vehicle strike said devices.

As it is well known, said devices are essentially constituted by two spherical elements assembled together along their base and one of which receives the light rays and causes them to converge on the other, the rear face of which is silvered and therefore acts as a reflector.

These known apparatus are either concentric or eccentric, that is to say the elements of which they are made have either a common center or two different centers. The ratio of their radii may have any value, or it may correspond to the formula

$$R=\frac{r}{n-1}$$

in which R and r are the radii in question and n is the index of refraction of the matter of which the device is made.

These devices have certain drawbacks. When the radii comply with the above formula, the luminosity at infinity is satisfactory, but when the distance from the edvice decreases, the luminosity becomes practically zero, due to the fact that the very small divergence of the device does not enable the rays that strike it to be returned into the observer's eye, which does not coincide with the light source.

In auto-collimating devices of the eccentric type, such as shown by Fig. 1 of the appended drawings, distance a is smaller than distance b. Now, the divergence of the light beam depends solely upon the value of the sum of the radii R and r, or, in the present case, this value minus e, e designating the eccentricity, that is to say the distance between the centers of the spherical elements. If distance a is correctly determined for an operation of the device at infinity, the incident ray will be reflected with a very small divergence, which is satisfactory for visibility at long distance. As the vehicle which illuminates the signal is coming nearer thereto, the incident ray is reflected with a divergence smaller than that corresponding to a greater distance. Therefore, the reflected rays are no longer visible for the driver and passengers of the vehicle. The device has thus become inoperative.

Fig. 2 of the appended drawings is a diagram illustrating this phenomenon. It shows a curve of operation for different angles to the incident ray with respect to a normal and for a uniform divergence ranging approximately from 10 to $^{15}\!/_{1000}$. This curve shows that the luminosity is maximum for an angle of incidence α corresponding to a certain distance from the vehicle to the reflecting device. Now, if the signal is illuminated under an angle equal to α, this means that the light source, headlight of the vehicle for instance, is close to the device and the distance from the observer's eye and the light source is no longer negligible as compared to the distance from the signal to the light source. As the divergence necessary for making it possible to see the signal should be, not 10 or $^{15}\!/_{1000}$, but about $^{1}\!/_{10}$, that is to say approximately ten times the actual value, the devices of the type above mentioned, as they are now made, are not satisfactory since they are designed with divergences as low as the first mentioned values. Practically, the light beam striking the reflecting devices will be reflected onto the light source alone. In other words, the divergence decreases when the angle of the incident ray with respect to the normal decreases. Now, an interesting working of the device, for practical purposes, would call for an inverse condition.

The object of the present invention is to provide self-collimating devices which avoid the above mentioned drawbacks.

According to an essential feature of the present invention, both of the light concentrating and light reflecting elements are spherical but at least one of them is of multiple structure, that is to say includes portions of different radii, respectively.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Figs. 1 and 2 are explanatory views relating to the prior art, as above mentioned;

Fig. 3 is a diagrammatical view of a first embodiment of the present invention;

Fig. 4 is a vertical sectional view of a modification of this embodiment;

Fig. 5 is a front view corresponding to Fig. 4;

Fig. 6 is a plan view corresponding to Figs. 4 and 5;

Fig. 7 is a diagrammatical view illustrating the principle of a second embodiment of the present invention;

Fig. 8 is a vertical sectional view of said second embodiment;

Fig. 9 is a front view corresponding to said Fig. 8;

Fig. 10 is a vertical sectional view of a modification;

Figs. 11 and 12 are explanatory diagrams showing two different positions of the device according to the invention;

Fig. 13 is a vertical section of still another modification;

Fig. 14 is a vertical section of still another modification;

Fig. 15 is a plan view corresponding to said Fig. 14.

In the embodiment illustrated by Fig. 3, the device or apparatus according to the invention includes a front spherical lens L, the radius of which is r, and a rear reflecting element T the reflecting faces C1, C2, C3 and C4 of which have decreasing respective radii R1, R2, R3 and R4, respectively. The apparatus has the shape of a body of revolution about axis Y—Y.

When the signals are to be seen from a great distance at different angles, the spherical surfaces of Fig. 3 are advantageously replaced by tore-shaped surfaces which are obtained by revolving the profile of Fig. 3, not about axis Y—Y but about axis X—X, and through an angle of 180°. In this way, I obtain a self-collimating device such as shown by Figs. 4, 5 and 6.

According to the invention, the radii of reflective surfaces C1, C2, C3, C4 are given by the following formulas:

$$R_1 = K_1 \frac{r}{n-1};\ R_2 = K_2 \frac{r}{n-1};\ R_3 = K_3 \frac{r}{n-1};\ R_4 = K_4 \frac{r}{n-1}$$

coefficient K ranging practically from 0.65 to 0.90 and depending upon the conditions of utilization of the apparatus.

On the other hand, these formulas show that the devices according to the invention have, over those used prior to said invention, the advantage of substantially reducing the space occupied by the apparatus, that is to say of corresponding, for a greatly higher efficiency, to a substantially smaller volume and therefore a considerably lower cost.

Of course, the number of reflecting portions, their arrangement, the values of the radii of curvature and other particular data can vary within a great range without departing from the principle of the invention.

Figs. 7 to 15 relate to another embodiment of the invention. The principle is illustrated by Fig. 7. It will be readily understood that a very little divergent beam corresponds to the reflecting surface being located at the point of convergence D of the rays received by the front lens. The divergence of the apparatus may be made more or less important by modifying the position of the reflector, as shown in dotted lines, the divergence being practically proportional to the value of the variation of position. It should be noted that, in position D, the divergence would be zero, so that the reflector practically never occupies this position, but that shown at D′, slightly ahead of D. Positions G and H correspond respectively to positions of the reflector in front of, and behind, said position D′, respectively, these positions G and H corresponding to a substantial divergence of the reflected beam.

Figs. 8 and 9 show, in section and plan view respectively, an arrangement according to this embodiment of the invention. The front and rear elements of this device are concentric and the reflecting portion T has a single curvature, while the front lens L is made of several portions consisting of spherical or ellipsoid-shaped annular elements.

The radius R′ of the reflecting surface T is therefore chosen in such manner as to correspond to a reflected beam of very small divergence, received by the central portion of the front lens L, of radius a. If the obliquity of the incident beam increases, so that it comes to impinge upon the portion of the front lens the radius of which is b, the point of convergence is modified, being ahead of the surface of the reflector, at a distance therefrom equal to a value proportional to the divergence that is chosen.

Fig. 10 is a sectional view of a modification in which the radius of the central portion of the front lens L is greater than the radius of the marginal portion, in opposition to the arrangement of the preceding embodiment. In this case, the point of convergence for the light rays that have struck the marginal portion is located behind the surface of the reflector.

As shown by Fig. 11, apparatus such as those shown by Figs. 8 and 10 reflect with a very small divergence an incident beam of direction M, but with a substantial divergence a light beam of direction N.

Fig. 12 shows the case of an apparatus which, instead of being disposed as shown by Fig. 11, is to be placed substantially at the level of the ground, for instance to indicate the axis of a road or to signal a turn, or again as a signalling element for aircrafts. In this case, the incident beam of direction O must be reflected without divergence; the incident beam of direction P is to be reflected with a substantial divergence and the incident beam of direction Q is to be reflected with a considerable divergence. Whatever be the shape of the front lens, whether it is a sphere, an ellipsoid, or the like, or a combination of such elements, the parts corresponding to reflection without divergence or with but a very small divergence will be calculated in such manner as to give the image of a remote source of light at a point very close to the reflecting surface. For the beams of more important divergence, the front elements are, on the contrary, arranged in such manner as to give the image of the source ahead of, or behind the reflecting surface, and at a distance thereof proportional to the necessary divergence.

Fig. 13 shows an example of a device intended to be horizontally disposed, as shown by Fig. 12. In this case, the front lens has three different divergences obtained by means of spherical portions of radius o (o=a), p, q, corresponding respectively to increasing divergences.

It should also be noted that the surfaces of the front lens are not necessarily solids of revolution but may be constituted by revolution of a given profile, as shown by Figs. 14 and 15, which show an apparatus intended to work in the vertical position.

Instead of being applied directly on the rear face of the reflecting element, the coating which ensures reflection (silvering or the like) can be separated from the apparatus by a fluorescent layer, and of course, in this case, the apparatus must be made of a matter which is transparent to invisible rays, whereby, if it is illuminated by a source of rays of this type, the visibility is ensured by the fluorescence of the layer which is located in front of the reflecting layer.

Of course, the devices according to the invention can be made of glass, synthetic resins or other compositions of matter and, broadly speaking, any suitable material.

ANDRÉ GARBARINI.

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BY A. P. C.

A. GARBARINI

MULTIPLE DIVERGENCE REFLECTING DEVICES

Filed Aug. 9, 1939

Serial No. 289,326

3 Sheets-Sheet 1

Fig. 3

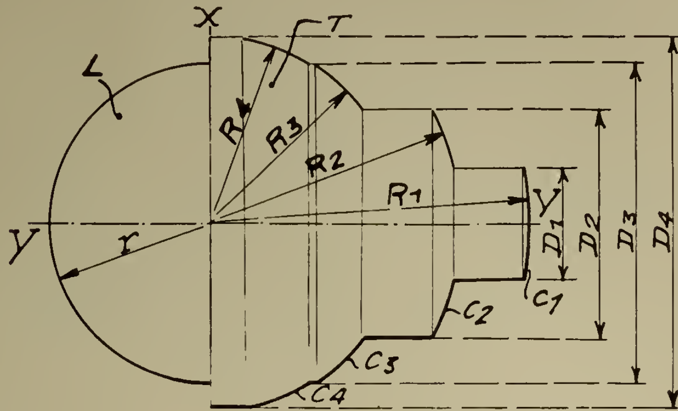
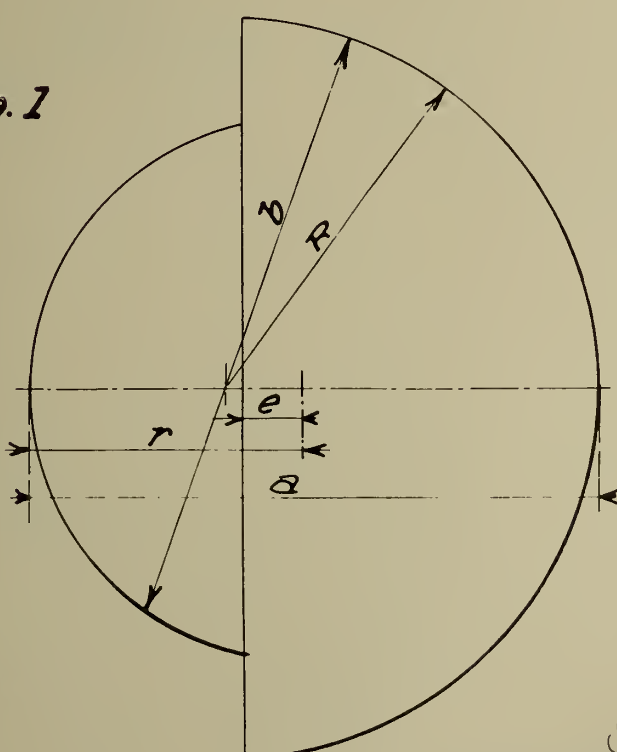


Fig. 1



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JUNE 1, 1943.	MULTIPLE DIVERGENCE REFLECTING DEVICES	289,326
BY A. P. C.	Filed Aug. 9, 1939	3 Sheets-Sheet 2

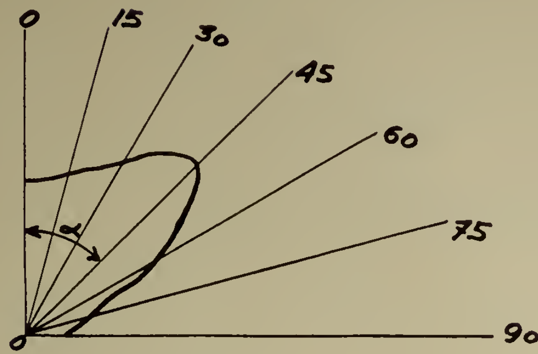


Fig. 2

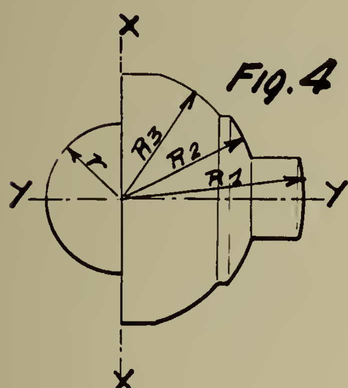


Fig. 4

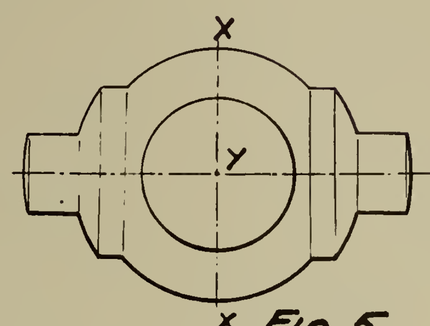
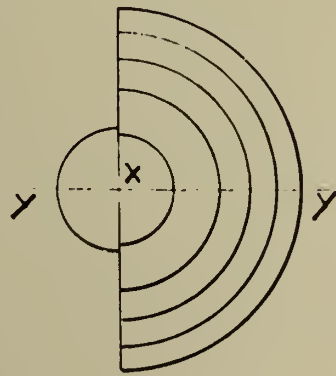


Fig. 5

Fig. 6



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MULTIPLE DIVERGENCE REFLECTING DEVICES

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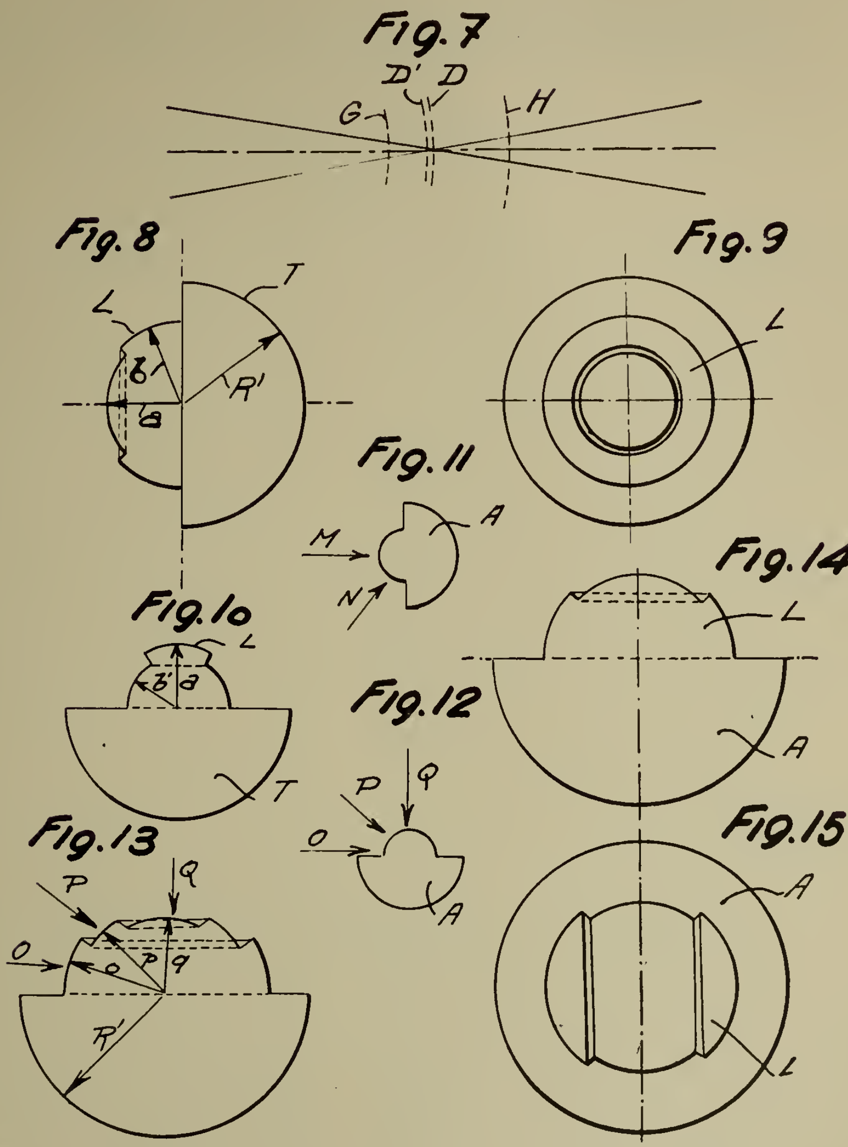
3 Sheets-Sheet 3



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MICRO-PHOTOMETER

Gerhard Hansen, Jena, Germany; vested in the Alien Property Custodian

Application filed September 11, 1939

In the technical use of spectro-analyses, it is becoming more and more important to attain as high a rapidity as possible in the measurement of photographic exposures. This proceeding consists nearly always in measuring the density of the blackening of spectral lines in each spectrum of a great quantity of spectra looking much alike which are photographed on one plate. The measurement concerns especially two lines which have the same distance apart in all spectra photographed on the same plate. The distance between the lines to be measured is different however with different substances. Accordingly an apparatus is to be devised which permits the plate holder to be rapidly displaced over a distance that corresponds exactly to that between the two lines to be measured, especially because finding the lines generally takes up much time. The time required for measuring is considerably reduced as soon as the apparatus has once been adjusted to the distance apart of the lines in one spectrum. In this case, the measurement of the two lines of each spectrum merely requires that the plate is displaced from spectrum to spectrum, the plate holder being shifted by means of the apparatus to and fro between the two end positions. According to the invention, micro-photometers for rapidly measuring pairs of lines and especially pairs of spectral lines are provided with adjustable stops between which the plate holder can be displaced. Further, it is of importance that the plate holder can be reliably arrested in the two end positions. The image of a spectral line, which has in most cases only a breadth of less than 0.1 millimetre, is magnified 20 to 30 fold on the slit in front of the photo-electric cell. To avoid a readjustment in each end position, which would be tantamount to an additional loss of time, the plate holder is to assume always the same end positions and to be firmly arrested therein. For the sake of an easy displacement of this plate holder, it is necessary that no considerable power need be used for instance for operating mechanical arresting devices. The invention accordingly provides that arresting the plate holder in its two end positions adjustable by means of the stops is effected magnetically, conveniently by permanent magnets. To this effect, horse-shoe magnets are fixed to the displaceable plate holder, and iron plates fast with the stops constitute the pole pieces. It is naturally also possible to fix the stops to the displaceable plate holder and the permanent magnets to the stationary part supporting this holder. Further, it is convenient to use means that prevent the magnets and the said iron plates from touching each other completely, so that these parts cannot stick to each other and the plate holder can be withdrawn without much energy being required. Not only does the apparatus according to the invention thus fulfill in an ideal manner the demands set forth hereinbefore, but it is, moreover, exceedingly cheap.

In the accompanying drawing, which illustrates the invention, the apparatus is shown in

Fig. 1 in a view from below, and in

Fig. 2 in part-sectional side elevation.

A plate holder 1 having a rectangular aperture 2 is displaceable on a stationary base 3 having an aperture 4. The base 3 has bevelled guide surfaces 5, between which the plate holder 1 can be made to slide by means of rollers 6, 7 and 8. To the base 3 are fixed horse-shoe magnets 9 and 10. The plate holder 1 has stops which are constituted by a U-shaped iron part 15 and whose displacement relative to guide pieces 11 and 12 can be controlled very exactly through the agency of micrometer screws 13 and 14. To that end of the said iron part 15 which is nearest the magnet, a soft iron plate 16 is fixed by brass screws 17 and 18, which protrude approximately 0.5 millimetre above the plate 16 and prevent this plate from sticking to the magnet. By means of a milled head 19, the spectral lines can be accurately adjusted relatively to the slit of the photo-electric cell.

GERHARD HANSEN.

PUBLISHED
JUNE 1, 1943.
BY A. P. C.

G. HANSEN
MICRO-PHOTOMETER
Filed Sept. 11, 1939

Serial No.
294,277

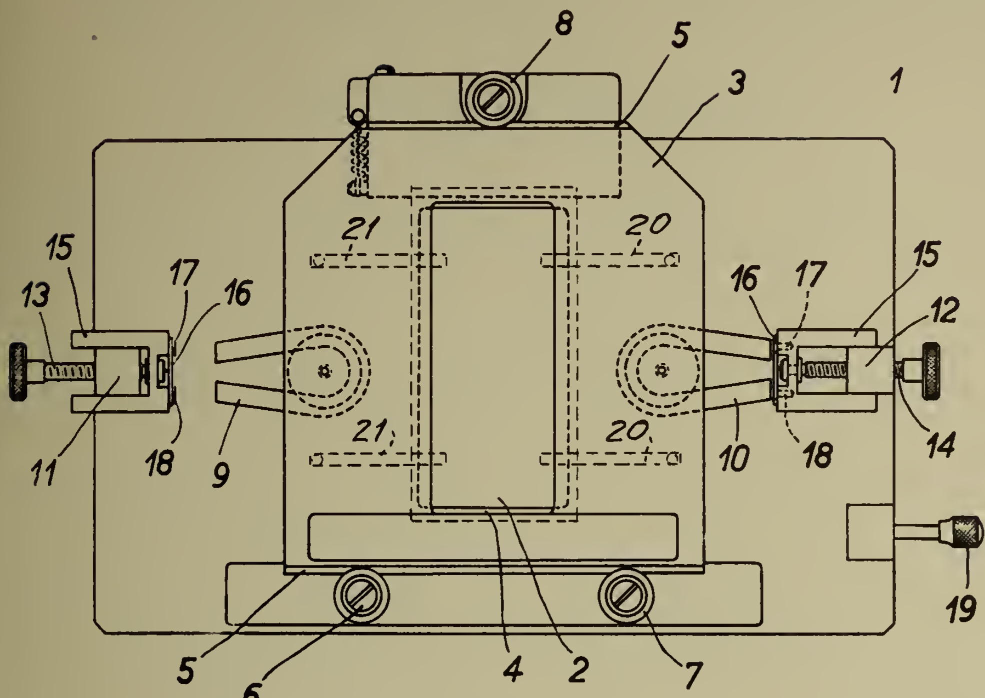

Fig. 1

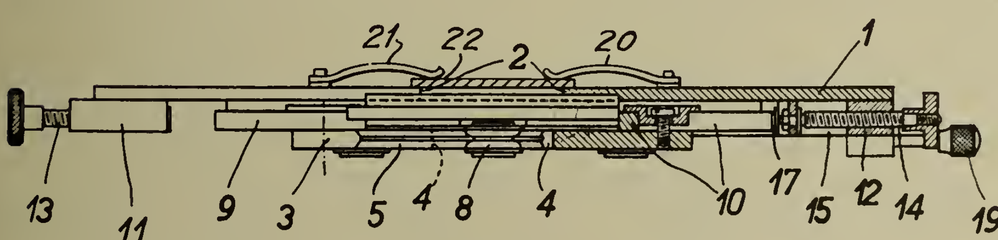

Fig. 2

Inventor:

Gerhard Hansen.

Published June 1, 1943

Serial No. 299,160

ALIEN PROPERTY CUSTODIAN

DOWELS

Johannes Stiegelmeyer, Hannover-Wulfel, Germany; vested in the Alien Property Custodian

Application filed October 12, 1939

My invention relates to improvements in fastening means of the type known as dowels, adapted to be driven into walls or masonry made of bricks, tiles or the like, and which are used for holding therein bolts, pins, hooks, screws etc. collectively called hereinafter bolts.

The principal object of the invention is to provide a structurally improved dowel for the purpose set forth, wherein bolts can be quickly fixed and in a dependable manner, even by unskilled people, irrespectively of whether or not the bolts are threaded, and which type of screw threads they may be provided with.

The invention further aims at providing a structurally improved dowel, which can be easily made in large quantities and can be put on the market at a low price.

Still other objects of the invention will become incidentally apparent to practitioners in this field as the description proceeds.

The nature and scope of the invention will be more fully understood from the following specification taken together with the attached drawing, wherein

Fig. 1 is a longitudinal section through a dowel redesigned according to this invention and shown in a somewhat enlarged scale,

Fig. 2 is a front view of the dowel as seen from the right side of Fig. 1,

Fig. 3 shows by way of an example a rectangular threadless hook to be fixed according to this invention in dowels of the design shown.

Fig. 4 is a longitudinal section through a dowel driven into a wall, wherein a hook as shown in Fig. 3 is fixed.

Fig. 5 shows a threaded, arc shaped hook to be used for the purposes of this invention.

Fig. 6 is a longitudinal section through a dowel driven into a wall and holding a hook of the design shown in Fig. 5,

Fig. 7 shows by way of an example a wood screw to be used for the purposes of this invention,

Fig. 8 is a longitudinal section through a dowel driven into a wall and holding a wood screw of the design shown in Fig. 7.

The fastening means redesigned with the objects in view outlined above and shown in Figs. 1 and 2 comprises:

A tubular dowel *a* preferably made of sheet steel and presenting at its rear end a circumferential bevelled cutting edge *b*, outwardly directed; said dowel is internally formed near its front end *c* with a plurality of circumferentially spaced screw dies *e* integral with and cut into shoulders *d* of the dowel projecting thereinto, owing to radial impressions made in the tube.

The said screw dies *e* are hardened, so as to promote their cutting action.

As seen in Figs. 3 and 4 a threadless rectangular bolt *f* on being turned into the dowel *a'* will be automatically threaded at *f'* and thereby firmly fixed in the dowel.

An arc shaped hook *g*, the shaft *h* of which represents a wood screw, will get new threads piercing the threads of the wood screw, on being turned into the dowel *a'*, as seen in Figs. 5 and 6.

A conventional wood screw *i*, *k* having a slit head, when being turned into a dowel *a''* of appropriate diameter, as seen in Figs. 7 and 8, may receive additional threads adjacent the threads of the screw *k*. The additional threads serve for fixing the screw *i* in the dowel *a''*.

Good results have been obtained with dowels made of flat blanks of sheet steel which were rolled up so as to present tubular shells, and in which three shoulders *d* were formed by locally compressing the shells from without; said shoulders were threaded, so as to obtain screw dies *e*, the cutting edges *b* were formed and finally the dowels are hardened.

Various other modifications and changes may be conveniently made in the structural details of dowels of the improved design described, without substantially departing from the spirit and the salient ideas of this invention.

JOHANNES STIEGELMEYER.

PUBLISHED JUNE 1, 1943.
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DOWELS

Filed Oct. 12, 1939

Serial No. 299,160

Fig. 2

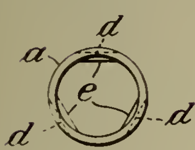


Fig. 1

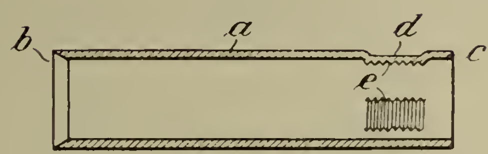


Fig. 4

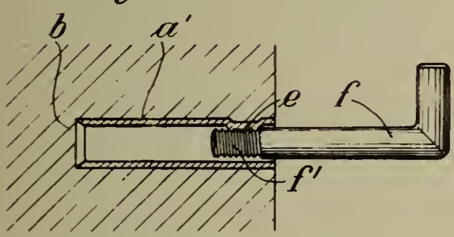


Fig. 3

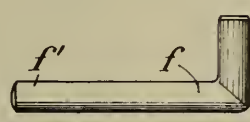


Fig. 6

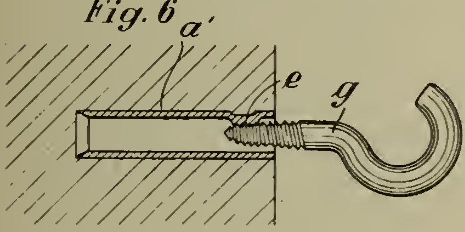


Fig. 5

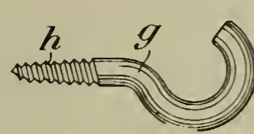


Fig. 8

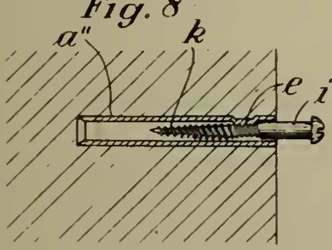
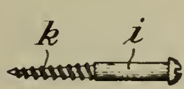


Fig. 7



Inventor
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By
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Published June 1, 1943

Serial No. 303,182

ALIEN PROPERTY CUSTODIAN

SWIVELLING SCREW PROPELLERS

William Arthur Loth and Sebastienne Marie Henriette Guyot, Paris, France; vested in the Alien Property Custodian

Application filed November 7, 1939

This patent application is a continuation in part of our earlier patent application Serial N° 156,064 filed on July 28, 1937, for "Stabilisation of aircraft and in particular of aircraft based on lifting systems which are mobile relatively to them or on systems which are at the same time lifting and propelling and mobile relatively to them", and certain parts of the present application will be found in the earlier application.

The present invention relates to screw propellers the hub of which is mounted on a driving shaft by means of a universal joint so that the axis of rotation of the propeller can be freely displaced into any angular position relatively to said shaft within an imaginary cone the apex of which coincides with the centre of the joint, the axis of the cone normally coinciding with the axis of rotation of the propeller. This property which the propeller possesses is hereinafter referred to as "swivelling".

According to the present invention a swivelling screw propeller as defined above is characterised in that the said joint is homokinetic that it maintains the ratio of the instantaneous speeds of rotation of the propeller and of the driving shaft constant for all angular positions of the axis of rotation of the propeller within the cone, and also during the entire duration of all movements of inclination of the axis of rotation of the propeller relatively to the driving shaft.

This property of homokineticism is not displayed by Cardan joints in which the ratio of the instantaneous speeds of inclined driving and driven shafts is constant only at certain points during rotation.

A further characteristic feature of the invention resides in the fact that when the propeller is inclined so that the axis of rotation thereof coincides with the surface of the imaginary cone the apex angle of which has been preselected according to the conditions, the propeller is subjected to an impulse (hereinafter referred to as a precession impulse) which compels the axis of rotation of the propeller to describe a portion of said conic surface (the precession cone). In this manner the axis of rotation of the propeller reaches a position in which the propeller exerts a stabilising torque as will be explained hereinafter. This precession impulse takes place without producing (and consequently having to overcome) acceleration and deceleration forces, owing to the fact that the joint is homokinetic.

The operation previously described is not affected by adjustment of the axis of rotation of the propeller relative to the driving axis either before or during movement of the body which the propeller is propelling—in the case of an aeroplane during flight for instance.

It is to be understood that a swivelling screw propeller in accordance with the present invention is not to be limited as to the type of movable body with which it may be associated. This may be an aeroplane, land vehicle, surface water vessel or under water craft and this broad application is to be understood when the term "movable body" is used throughout the description and claims.

Homokinetic joints are well known per se and there is a type of such joint which comprises spherical members drivingly coupled to each other by a series of balls engaging meridian race grooves in the adjacent faces of said members, and a cage engaging said balls which are maintained in a diametral plane.

We are sware that it has previously been proposed in British specification numbered 878 of 1903, to mount a swivelling screw propeller on an airship by means of a joint which is adapted to maintain constant the ratio of the instantaneous speeds of rotation of the propeller and of the driving shaft when the axis of rotation of the propeller has been displaced to a new position but which forces the propeller to undergo certain variations in the speed of rotation while it is being displaced with respect to the driving shaft. Such a joint therefore does not fulfill the condition of homokineticism as defined above.

It has previously been proposed in the gimbal mountings of apparatus used on board ships, aircraft or other oscillating bodies or in similar universal joint mechanisms to provide two gimbal rings, universal joints or the like arranged in series between the apparatus and the oscillating body, the two rings or joints being connected by a Cardan member controlled by the relative inclination of the apparatus and the oscillating body so that a constant-velocity (homokinetic) coupling is provided therebetween.

The accompanying drawings illustrate, by way of example only, some embodiments of the invention.

Figure 1 is a sectional elevation of a propeller hub constructed in accordance with the present invention;

Figure 2 is on a smaller scale; the upper part being a sectional plan view taken on the line *IIb*—*IIb* of Figure 1; the lower part being a sectional plan view the section being taken on the line *IIa*—*IIa* of Figure 1;

Figure 3 is a sectional elevation of a second construction;

Figure 4 is an elevation of a helicopter provided with the propeller shown in Figure 3;

Figures 5, 6 and 7 are diagrammatic views showing the operation of the homokinetic joint and mechanism for bringing the propeller into the stabilising position in which the stabilising torque is then exerted;

Figure 8 is a sectional elevation of a constructional embodiment corresponding to Figure 3;

Figure 9 is a partial horizontal section made according to line IIc—IIc of Figure 8.

The most general problem of the control of a swivelling propeller as applied by way of example to helicopters will now be described at length, stress being laid on the problem of stabilisation.

Referring to Figures 1 and 2 of the accompanying drawings; the rotor blades P are secured to one element of the homokinetic joint generally indicated by Y the element being adapted to be rotated (when not inclined) about the vertical axis A_m which in the non-inclined condition coincides with the axis V of the driving shaft. On the latter shaft (which is not shown) is mounted pinion I which drives the joint Y through reduction gearing J and the ring gear K.

The mechanism described above is enclosed within a casing C_y which is formed in two separate parts, the upper part F_s and the lower part F_i which may be considered to be parts of the fuselage or stator.

A bearing R_4 is disposed between the casing C_y and the joint Y to enable the rotor to be rotatably driven around the casing, whilst a thrust bearing R_5 is also provided between the joint and casing.

The homokinetic joint comprises the two elements having the spherical surfaces S_i and S_e.

A groove T_1 is formed on the surface S_i and a second groove T_2 is formed on the surface S_e, both said grooves being equally inclined but in opposite directions to a meridian passing through a ball B. The grooves are adapted to cooperate and have maintained therebetween the ball B. There are provided three pairs of such grooves spaced equally around the joint each pair with a ball (see Figure 2), which balls are associated with a connecting cage E extending around said joint. Any device may be used which maintains the centres of the balls in a plane bisecting the angle between the axes of the driving and driven shaft when the latter is inclined with reference to the former.

It should be noted that if the grooves are perfect loxodromics (that is are parts of curves which cross all the meridians of the spheres at the same angle of inclination) it follows that the balls will be maintained on a diametrical circle as with this arrangement the balls are automatically maintained in the bisecting plane.

From the above description it is clear that the homokinetic joint Y is rotatably driven from the the pinion I, through reducing gear J, ring gear K, and due to the coaction of the balls B and grooves T_1 and T_2 the drive is transmitted to the outer element of the joint and hence to the blades P. It will also be apparent that it is possible to displace the outer spherical element relative to the inner element (thereby inclining the plane of the rotor blades) and it is clear that since the joint is homokinetic this may be done without varying the speed of rotation of the rotor.

A stabilising mechanism is provided in conjunction with the homokinetic mounting of the blades P.

This mechanism comprises a driving annulus C_1 disposed between bearings R_1 and R_2 (respectively engaging the upper part F_s of the casing C_y and the inner element of the joint Y) said annulus being driven by the inner element through a ring gear U_1 (secured to said element) and reduction planet gears S engaging a ring gear U_2 secured to said annulus C_1.

A driven annulus C_2 which is capable of engagement with the driving annulus C_1 is mounted within the outer element of joint Y by means of a bearing R_3 so that it is free to rotate therein. The outer face of the annulus C_1 or the inner face of annulus C_2 is faced with any well known friction lining material. The two faces (of the annuli C_1 and C_2) are so designed that upon the outer spherical element of the homokinetic joint being inclined the faces are gradually brought into engagement until they ultimately become wedged and locked together.

There will firstly be described how, when the rotor is subjected to disturbance, it is in consequence subjected by the stabilising mechanism to an artificial precession movement, and, secondly, the effect of the latter.

The stabilising mechanism becomes operative when the rotor is subjected to a disturbance so that the axis of the rotor is moved into an inclined position with reference to the axis of the driving shaft to such an extent that the rotor axis coincides with the surface of the precession cone which we will assume has an apex angle of twice φ.

Referring to Figure 6, let it be assumed that a squall strikes the helicopter in the direction indicated by arrow D, so that the rotor is moved relatively to the stator from the position indicated in full lines to a position in which the right-hand blade is below the full line position (shown in chain-dotted lines W).

Due to the fact that the rotor is inclined by the squall the axis of rotation of the rotor will be moved from the vertical A_m towards A_o (see also Figures 5 and 7). Whilst inclination of the rotor axis towards A_o is taking place the rotor due to its rotation will act as a gyroscope the axis of rotation of which is inclined to the vertical. As a result of the gyroscopic effect produced the rotor axis will be rotated around vertical axis V. When the axis of the rotor becomes inclined at angle α to the vertical (which takes place at some point A), annulus C_2 will be brought into engagement with annulus C_1 which will by a rolling action therefore drive annulus C_2 and the latter will freely rotate in the outer spherical element. When due to the squall the axis of rotation is inclined at angle φ to the vertical (so that the axis coincides with the surface of the precession cone) which is assumed to take place at point A_1 (Figures 5 and 7) locking engagement between the annuli C_2 and C_1 takes place at point c (Figure 7). This locking engagement is such that annulus C_2 can no longer freely rotate in the outer spherical element but is constrained to move round with point c thereof in contact with annulus C_1 as the latter rotates, carrying with it the outer spherical element in an artificial precession movement. Consequently the axis of the annulus C_2 (which is also the axis of rotation of the rotor) is compelled to describe a portion of the surface of the precession cone between the points A_1 and A_2 (Figures 5 and 7). It is seen therefore that the annulus and rotor have been subjected to an artificial precession movement and swivelled around by annulus C_1 until the axis of rotation of the

rotor and annulus C_2 reaches A_2. At this point the thrust S (see Figure 6) of the rotor produces as is the case with a Cardan joint. With the lat- being the perpendicular distance of the line of action of the thrust from the centre of gravity K of the helicopter).

This stabilising torque counterbalances the squall and nullifies the effect thereof. In Figure 6 it is indicated by the arrow D_1, and the position of the rotor after it has been swivelled and during the action of the thrust in the direction of axis S is shown in the dotted position Z.

It is assumed that the squall is persistent and exerted in the same direction, that is from A_2 towards A_0 (Figure 5) so that when the rotor has been swivelled into the dotted position Z the squall will tend to move the rotor back towards the horizontal position. This results in disengagement of annulus C_2 from the locked position with annulus C_1 at *c*, so that annulus C_2 is again driven by annulus C_1 in free rotation in the outer spherical element. This tendency for the squall to move the rotor towards the horizontal position is opposed by the stabilising thrust itself so that a balanced state is set up.

As the squall dies away, the rotor returns to the initial horizontal position, and its axis A_m once again becomes vertical and conincides with V.

Considering the effect of the homokinetic joint during the sequence of events described above it is assumed that in Figure 5, r_0 is the diagrammatic representation of a rotor blade when the axis of rotation of the rotor is vertical. When due to the squall the rotor is inclined with reference to the vertical axis and assuming it has reached the position A_1 (that is the axis of rotation of the rotor is on the conic surface of the precession cone) then blade r_0 will take up position r_1. When the rotor is being made to swivel by the precession mechanism from A_1 to A_2 and the axis of rotation of the rotor has passed through angle i and reached the position A_3, in view of the fact that the joint is homokinetic the position of the blade r_1 at position A_3 will be r_2 which with respect to an imaginary plane passing through A_m, A_3 lags by an angle i assuming of course that the rotor is not being rotatably driven.

The homokinetic joint therefore has the effect of eliminating during swivelling of the rotor any tendency for the rotor blades to advance or retard as is the case with a cardan joint. With the latter the blade is advanced or retarded during swivelling of the rotor and produces acceleration or deceleration forces which would have to be overcome by the precession mechanism.

If the rotary motion of the driving shaft is resumed, in any swivelling movement of the rotor the blades will strictly retain their own driven rotation (that is they will not be accelerated or retarded). Consequently the energy required to produce rotation of the rotor when changing from point A_1 to A_2 will be neither increased nor decreased. This enables easy starting and maintenance of a swivelling movement without the necessity for additional expenditure of energy in overcoming such forces of acceleration and retardation.

In Figure 3 there is shown a construction in which the rotor may be adjusted to an initial inclination with reference to the driving shaft. Thus if it is desired to incline the rotor so that a forward driving component is produced this may be effected in the construction shown without causing locking engagement of the annuli C_2 and C_1 and consequent swivelling of the rotor. Should the rotor be inclined from this initial position of adustment due to a disturbance (such as a squall striking the machine) so that the axis of rotation reaches the surface of the cone of precession (the geometric axis of which is the axis of rotation of the rotor in its initially adjusted position) the rotor will be compelled to describe a portion of said conic surface.

In Figure 3 (as described with reference to Figure 1) the rotor blades P are secured to the joint Y which rotates on bearing R_4.

The precession mechanism comprises a carrier member C_3 disposed between bearings R_1 and R_2 (respectively engaging the upper part F_s of the casing and the inner spherical element of the joint), said carrier member being driven from the joint through a ring gear U_1 (secured to the inner spherical element of the joint) and reduction planet gears S engaging a ring gear U_2 secured to said member C_3.

In the mechanism shown in Figure 3 the driving annulus C_1 is not in fixed relationship to the inner spherical element but is capable of sliding on the carrier member C_3. In order that the annulus C_1 may be rotatably driven by member C_3 their adjacent faces are provided with a plurality of elongated grooves C_4 and C_5 respectively. These grooves are regularly disposed around the annulus and carrier member and have balls C_6 mounted therebetween. The latter form the common driving element.

A driven annulus C_2 which is capable of engagement with the driving annulus C_1 is mounted on the outer spherical element of the joint Y by means of the bearing R_3 so as to be free to rotate therein.

Suitable means (not shown) are provided for sliding the annulus C_1 on carrier member C_3, whilst the rotor is being tilted to bring its axis into the initially inclined position above referred to. Annulus C_1 is slid on member C_3 so as to be inclined to the driving axis by the same amount as the rotor and annulus C_2. This means that the annuli C_1 and C_2 are maintained parallel during and after tilting thereof.

This initially inclined axis of rotation of annulus C_1 and of the rotor now constitutes the geometric axis of the cone of precession.

When the axis of rotation of the rotor is inclined to said geometric axis (as by a squall) to such an extent that it reaches the surface of the cone of precession, annulus C_2 engages lockingly with annulus C_1 and the mechanism producing artificial precession is brought into operation as before.

The propeller blades may be provided with means for varying the pitch of the blades without departing from the scope of the invention.

Figures 8 and 9 show a constructional embodiment of the arrangement illustrated somewhat diagrammatically in Figure 3 and already described. In Figures 8 and 9 the same reference letters and numerals designate the same parts as in Figure 3.

In Figures 8 and 9 has been shown:

At N, the transmission of the driving movement to the shaft of the reducing device,

At O_1, a bushing which can be taken to pieces and which allows the mounting of balls B,

At O_2, the three pin joints which allow the mounting of the cage for the balls B,

At Q, set screws which allow of determining the orientation of the artificial precession mechanism.

In this constructional embodiment use is made of a means for inclining the rotor from the exhaust gases of the engine. This means is only an example among others to which recourse may be had.

It comprises:

An exhaust ring H_1 secured to the stator, a collector for the gas H_2 secured to the hub of the rotor and consequently rotating with the latter. Segments H_3 which can be adjusted so as to allow the admission of the gases of the exhaust ring H_1 to the collector H_2.

In Figure 8, the segments are assumed to be closed at the left and open at the right of said figure. It results therefrom, in this case, that the gases tend to produce an inclination of the rotor to the left, which would result, in fact, in a rearward inclination, owing to the gyroscopic effect.

In this embodiment, it is necessary to distinguish:

(1°) The mechanism controlling the inclination of the rotor realised in this case by a differential azimuthal emission of the gases into the rotor;

(2°) The mechanism controlling the orientation of the stabilising system, shown in the drawing by screws (connected to the pilot) adjusting the position of the annulus C_1.

Of course, after having determined by means of the first mechanism the inclination of the axis of the rotor, the pilot sets, parallel to said axis, the axis controlling the stabilization, by means of the second mechanism.

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SÉBASTIENNE MARIE HENRIETTE GUYOT.

PUBLISHED
JUNE 1, 1943.
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W. A. LOTH ET AL
SWIVELLING SCREW PROPELLERS
Filed Nov. 7, 1939

Serial No.
303,182
9 Sheets-Sheet 1

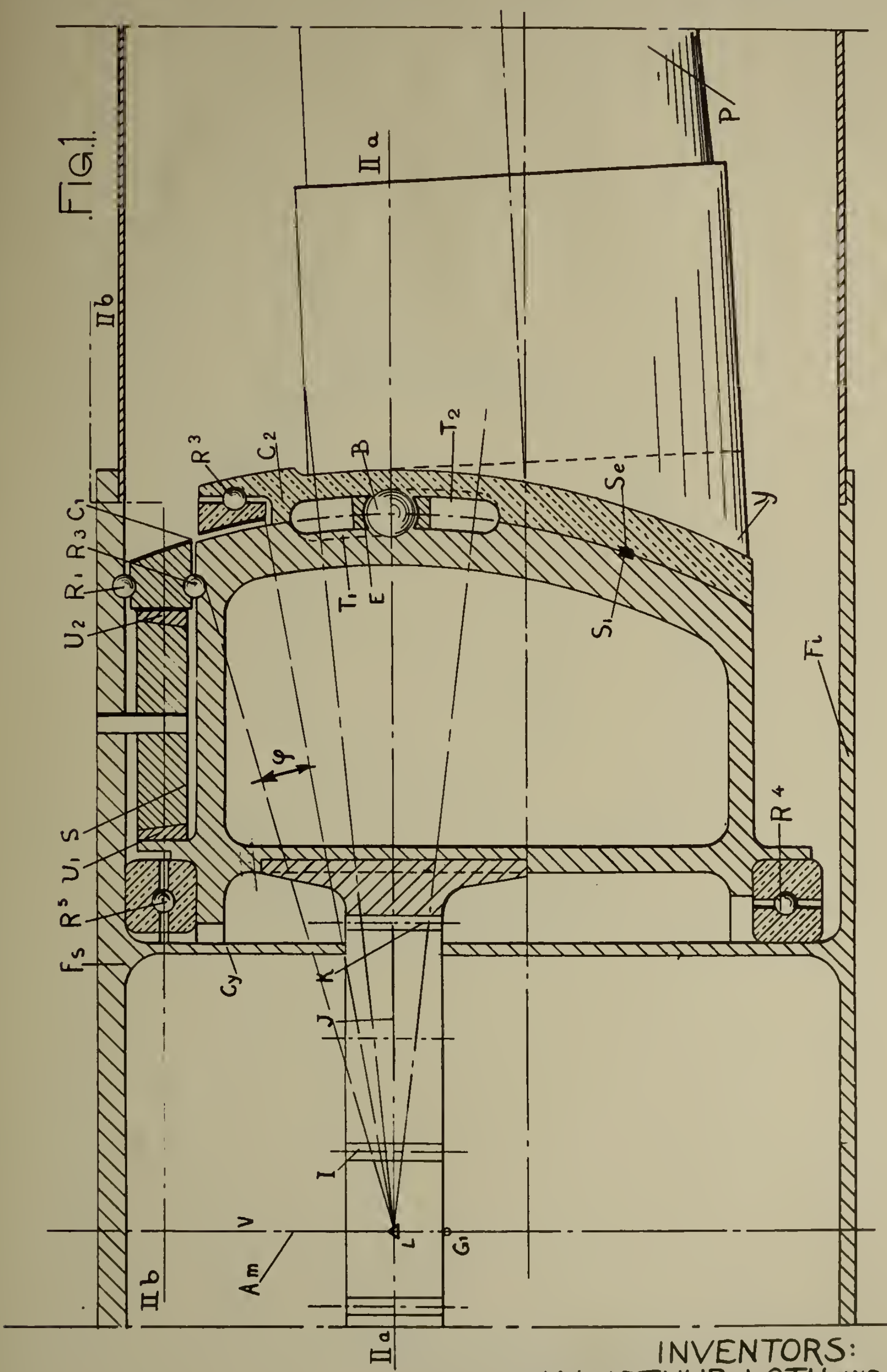

Fig. 1

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SWIVELLING SCREW PROPELLERS

Filed Nov. 7, 1939

Serial No. 303,182

9 Sheets-Sheet 2

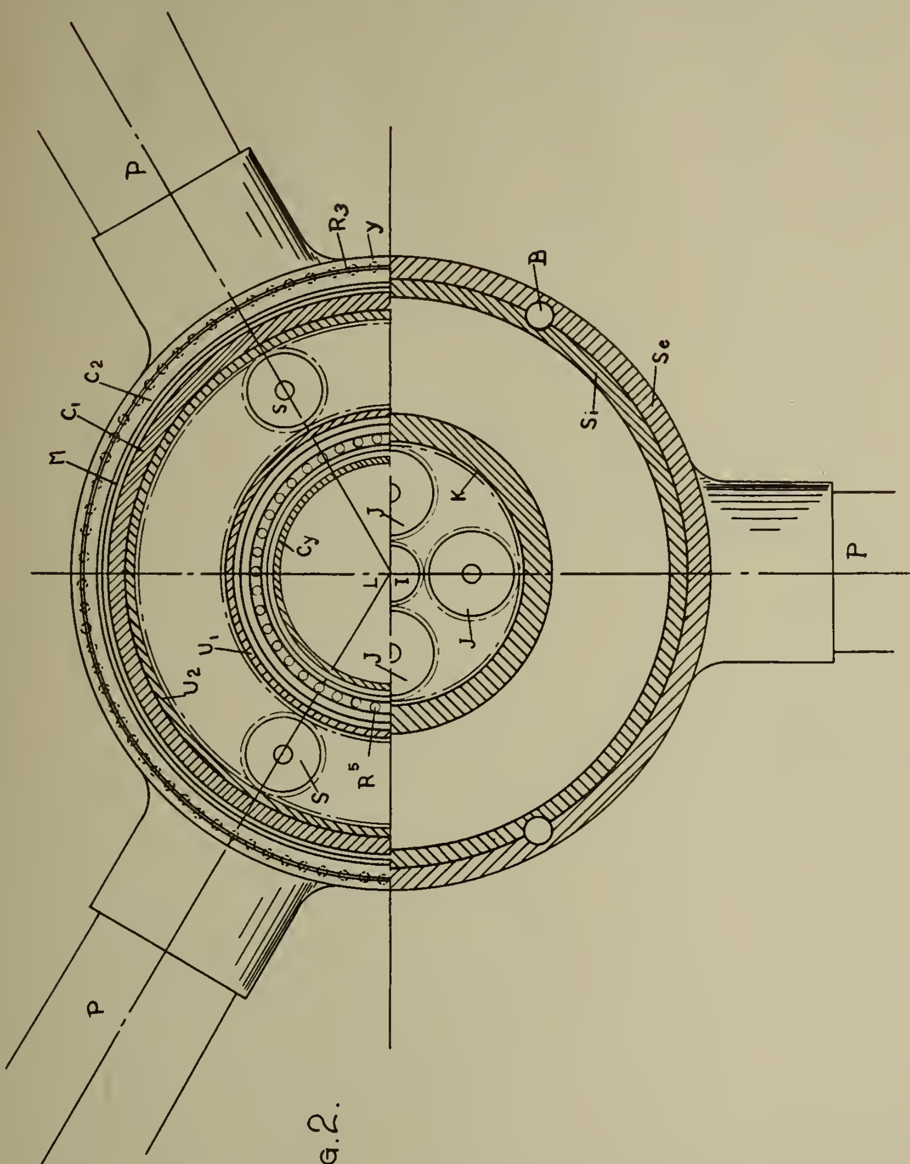

Fig. 2.

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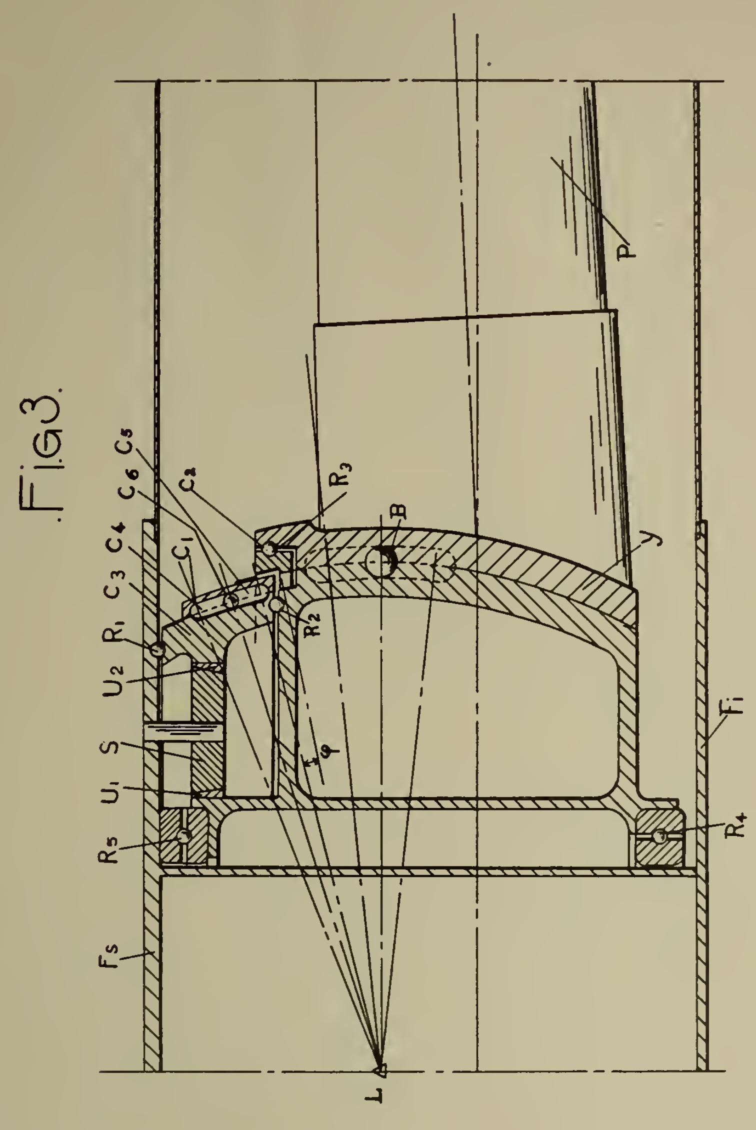
Serial No. 303,182
9 Sheets-Sheet 3



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JUNE 1, 1943.	SWIVELLING SCREW PROPELLERS	303,182
BY A. P. C.	Filed Nov. 7, 1939	9 Sheets-Sheet 4

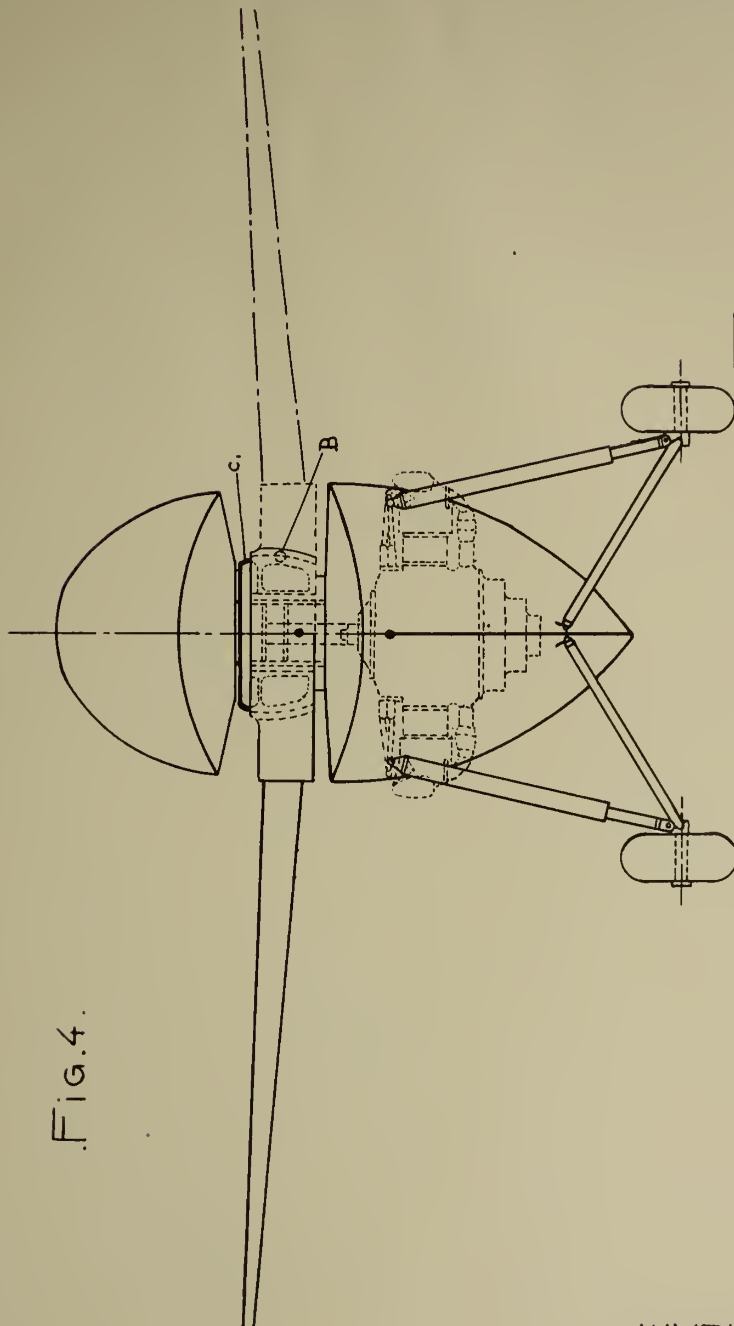

Fig. 4.

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SWIVELLING SCREW PROPELLERS

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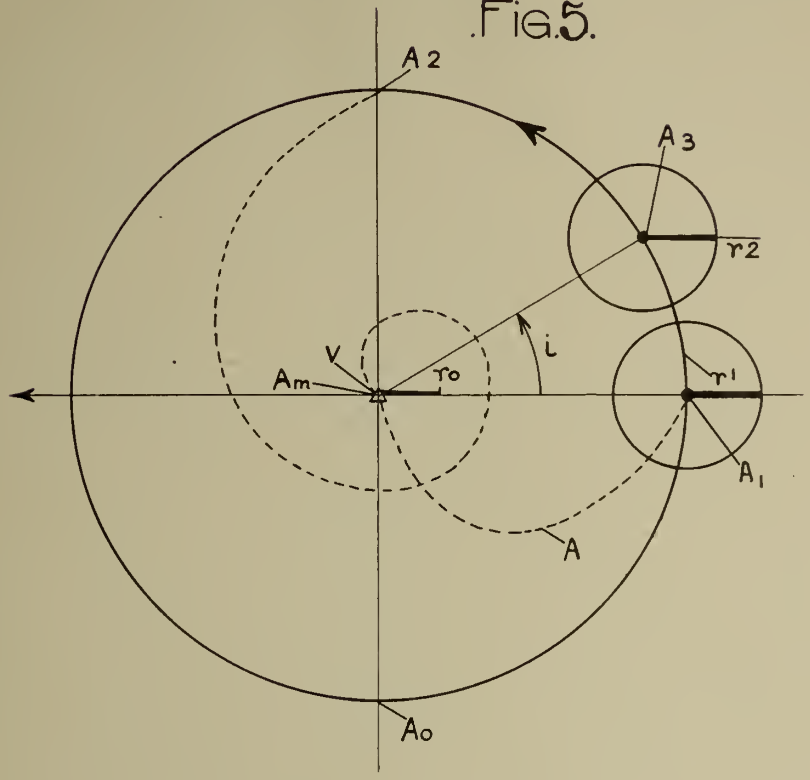
Fig. 5.



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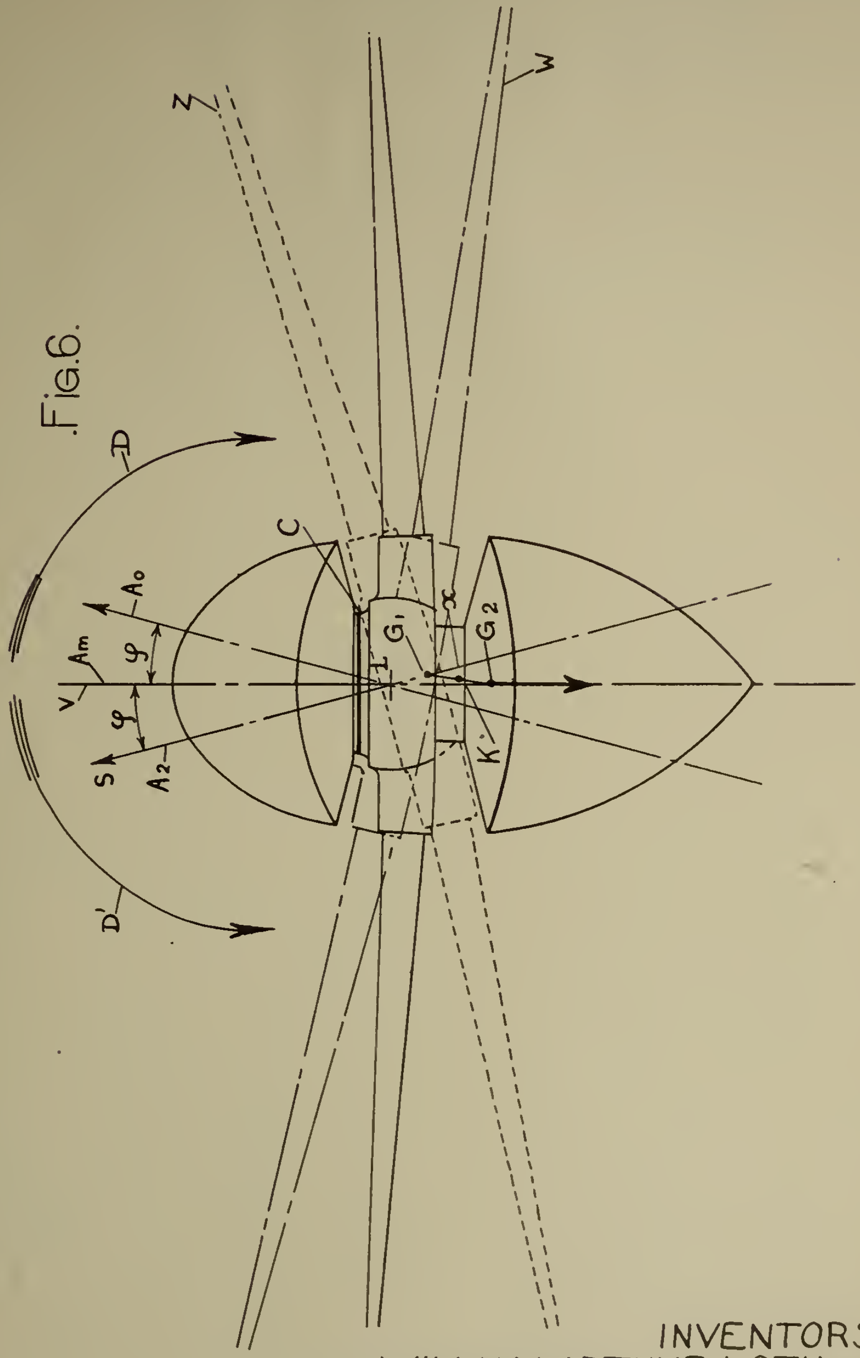

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Fig. 7.

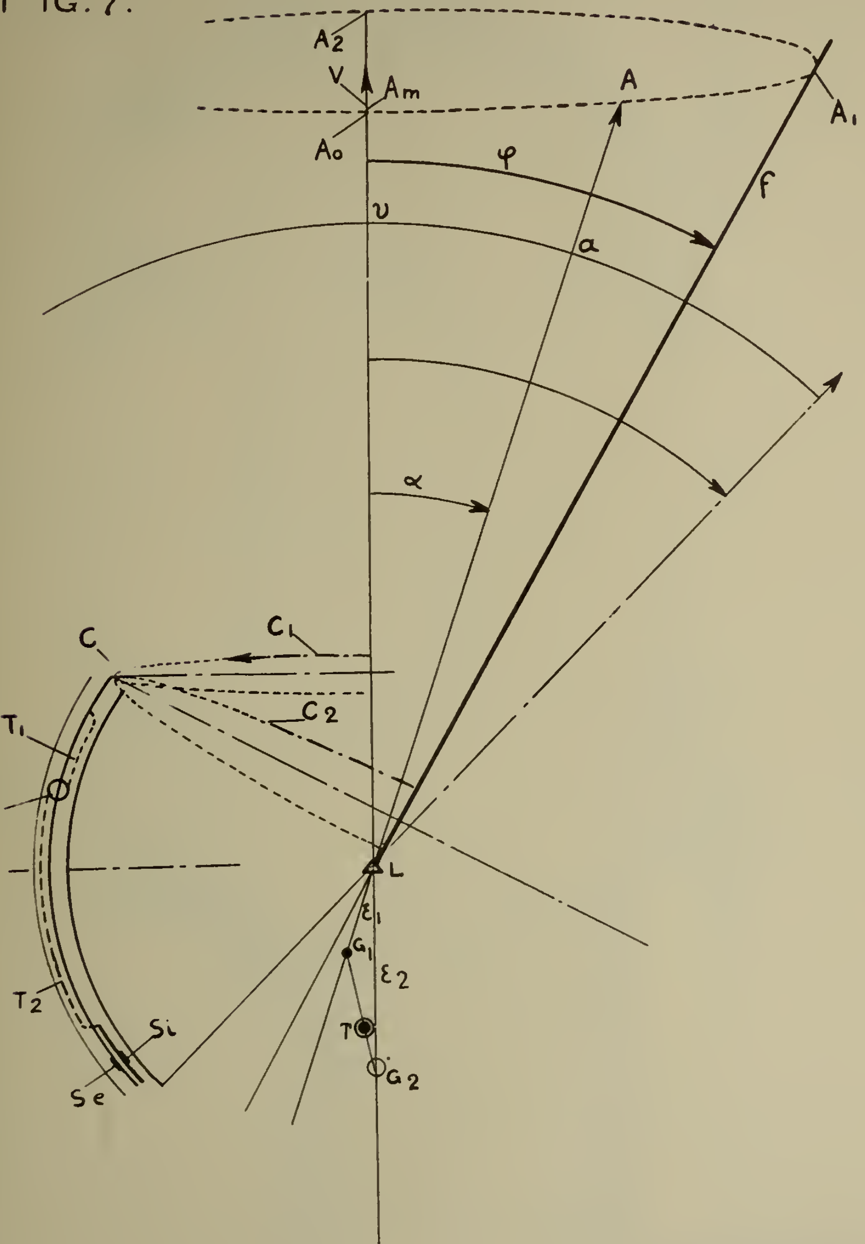

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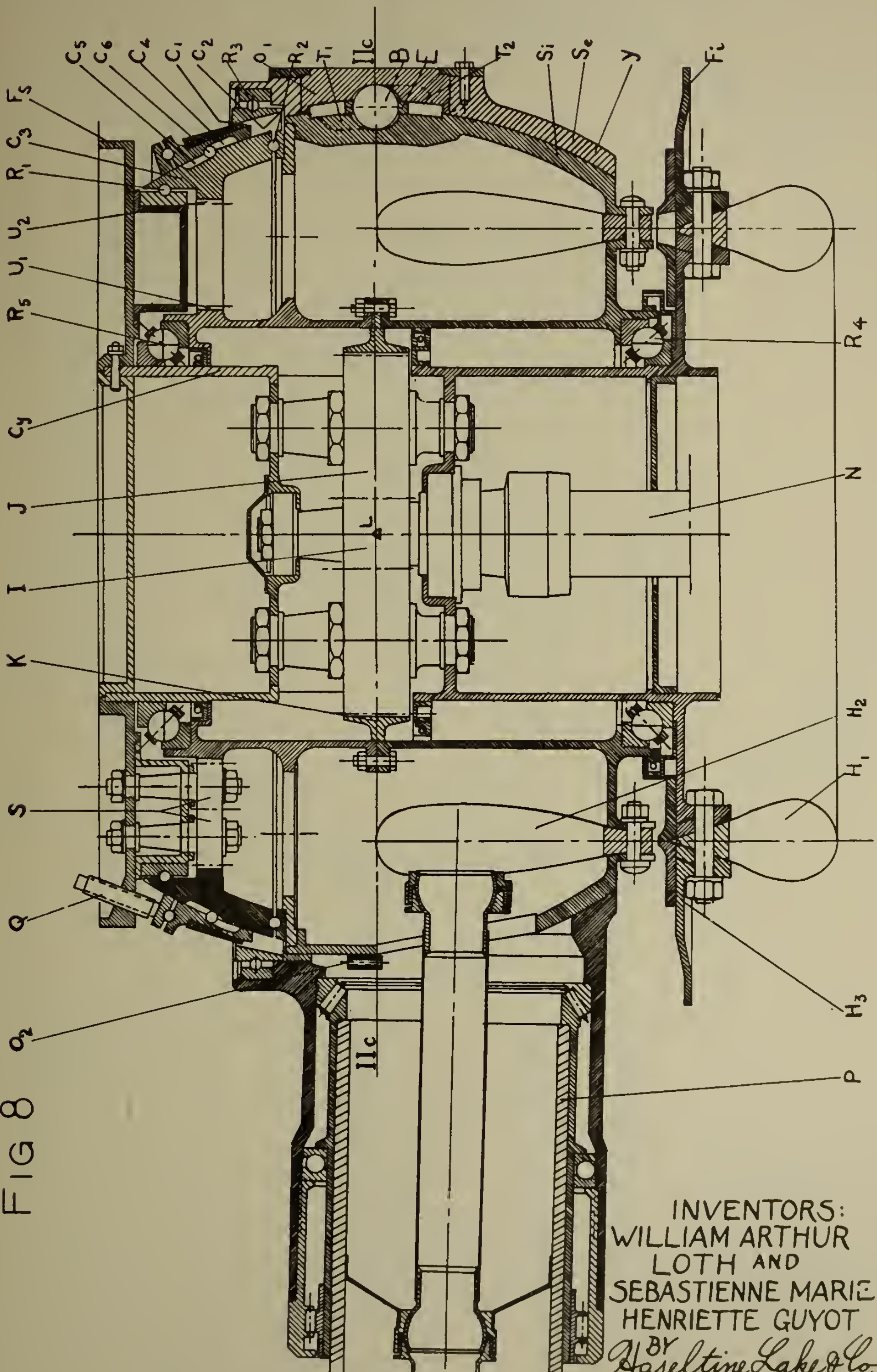
FIG 8



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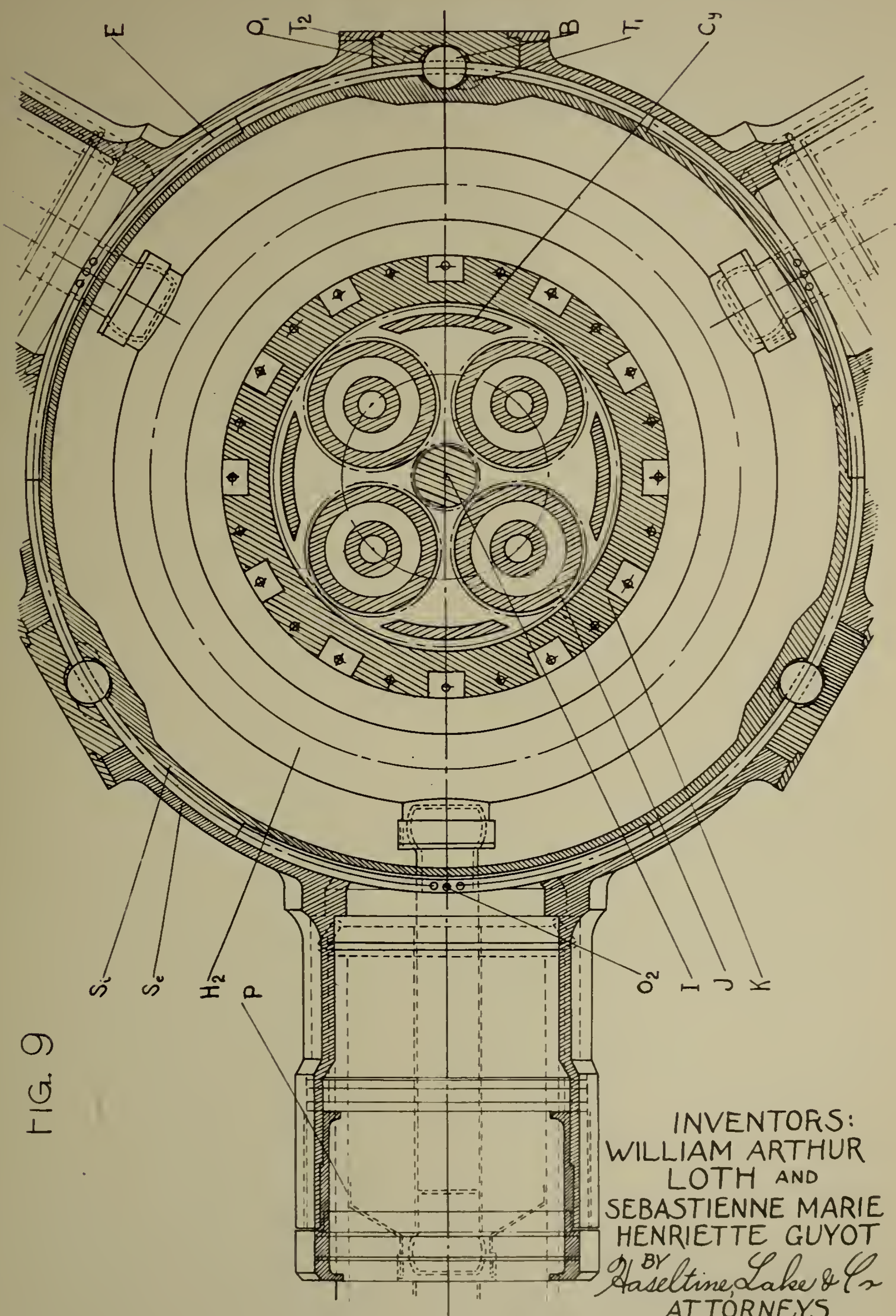

FIG. 9

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Published June 1, 1943

Serial No. 308,716

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE UNINTERRUPTED CASTING OF ARTICLES

Herbert Ruppik, Dusseldorf, Germany; vested in the Alien Property Custodian

Application filed December 11, 1939

The production of articles from metal is effected according to the methods known up to the present either by pouring the metal into a mold corresponding to the shape of the article, or the article is produced by shaping of the material in solid state by warm or cold treatment.

The invention relates preferably to the production by casting of rod-, band- or tube-shaped elements or of elements having a special cross-shape in such a manner, that it is no longer necessary to use for every casting procceding casting molds which have to be especially prepared and that also the expensive shapings by heat or cold are no longer necessary. For the solution of this problem the novelty consists therein that the molten material is directly conducted into a cooling medium so that a part or complete solidification of the material takes place directly after it has come into contact with the cooling medium; the speed at which the molten material enters into the cooling medium is regulated according to the relation of the profile to the cross-section of the workpiece to be produced and to the cooling speed of the molten material when the same enters into the cooling medium.

At the production of a rod-, band-, or tube-shaped workpiece or of workpieces of any desired section for instance from steel, according to the invention the material is molten, brought into a ladle and then conducted from the ladle directly into a bath of lead or of similar cooling medium. The spout, through which the steel flows into the cooling medium is equipped with a nozzle or the like corresponding in shape to the section of the workpiece to be produced, said spout projecting into the cooling medium.

The cooling medium possesses a higher specific gravity compared with the molten material. Consequently the workpiece is submitted to pressure from the outer side allround, wherefrom results that, the core being still liquid, bursting of the outer layer of the workpiece which has solidified or the production of fissures is avoided. A certain composition of the workpiece in its final state and a protection for the surface of the workpiece are attained by using a cooling medium which neither alloys with the molten material nor undergoes a chemical combination.

For securing a continuous casting it will be necessary in certain instances to expose the molten material in the ladle, besides to the hydrostatic pressure to an additional pressure. This additional pressure can be obtained by means of a piston in the ladle or by the employment of a pneumatic or hydraulic pressure.

The regulating of the additional pressure can further be effected by corresponding subsequent pouring of molten material into the ladle so that by the height to which the ladle is filled with molten material to pressure actually required on the nozzle is obtained.

Tensions in the workpiece may be avoided or equalized by regulating the temperature of the cooling bath by suitable means.

A further regulation of the temperature can be effected by maintaining the cooling bath at such temperatures that during the travel of the workpiece through the cooling bath a refining proceeding of the material is effected at the same time.

The nozzle in the cooling bath is preferably arranged so that its outlet aperture is directed towards the level of the cooling bath so that to the workpiece, owing to its lighter specific gravity, a buoyancy is given so that it rises through the cooling bath.

The above mentioned method can be applied also for the production of string casting and in this instance an improvement relative to the known methods consists therein that the molten steel is solidified on the surface in a mold or the like and conducted into a lead bath when the molten material comes out of the mold. Instead of the mold a thin-walled container made from sheet metal or the like may be used, this container during the continuous filling with molten material sinking deeper into the lead bath so that the level of the molten material is at approximately the same height as the level of the lead bath.

Several embodiments of the invention are diagrammatically illustrated in the accompanying drawing, in which

Fig. 1 illustrates the continuous casting of steel in a lead bath, whereas

Fig. 2 shows a part section of Fig. 1 on larger scale.

Fig. 3 illustrates the casting of the molten steel into a mold constructed as floating body, whereas

Fig. 4 illustrates the casting of the molten steel in a thin-walled container of sheet metal.

As shown in Figs. 1 and 2 the molten steel is poured into a ladle **2** and thence conducted through a nozzle **3** into a lead bath **4**. As soon as the liquid steel comes into contact with the nozzle wall which is cooled by the lead, a thin layer on the surface of the steel solidifies. Corresponding to the increasing shrinking of the solidified steel the nozzle **3** is tapered towards

its discharge aperture. The steel which at the beginning of the casting comes out of the middle of the nozzle-mouth in liquid state solidifies as soon as it comes into contact with the lead. Bursting of the solid steel layer, which is still thin after the molten material has come out of the nozzle **3**, by the pressure of the following liquid steel is prevented by the counter pressure of the liquid steel. The steel which has already solidified is designated in the drawing by **1***a* and it comes out of the lead bath **4** in the form of a rod-, band-, or tube-shaped workpiece or as a workpiece of any other desired section according to the cross-section of the mouth of the nozzle **3**.

In the ladle shown in Fig. 3 the molten steel is poured into the mold **5** which is cooled in known manner by any suitable cooling medium. At the beginning of the pouring in, the mold **5** is closed at the lower end by a piston **6** shiftable in vertical direction. The mold **5** projects into a lead bath **7**. When the mold **5** has been filled, the piston is moved downwards in the lead bath **7**. Owing to the high specific gravity of the steel, the forming steel string is kept under pressure on all sides, so that bursting of the string by the pressure of the steel which is still liquid in the interior of the string, and also the formation of fissures in the material after this has come out of the mold **5** are avoided. In a simple manner strings can thus be cast of a length and thickness which up to the present could never be attained.

The casting device consisting substantially of the mold **5** is preferably constructed as a floating body.

During the casting the level of the lead bath **7** rises in accordance with the quantity of lead displaced by the string casting. As the mold **5** is constructed as a floating body, it moves with the rising level of the lead bath so that it is not necessary to lead off the quantity of lead which is displaced by the string casting.

According to Fig. 1 the molten steel is poured into a thin-walled container **8** of sheet metal and this container is dipped into the lead bath **7**. This sheet metal container **8** can be substituted for the mold **5**. The container **8** is subdivided into several parts for assisting the continuous casting, said parts being adapted to be placed the one over the other. During the filling the container **8** continually sinks deeper into the lead bath **7** so that the level of the molten steel is approximately at the same height as the level of the lead bath. The thickness of the sheet metal plates from which the container **8** is made is such that the sheet metal plate can yield under the pressure of the liquid lead and is permanently pressed tightly against the steel.

HERBERT RUPPIK.

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H. RUPPIK
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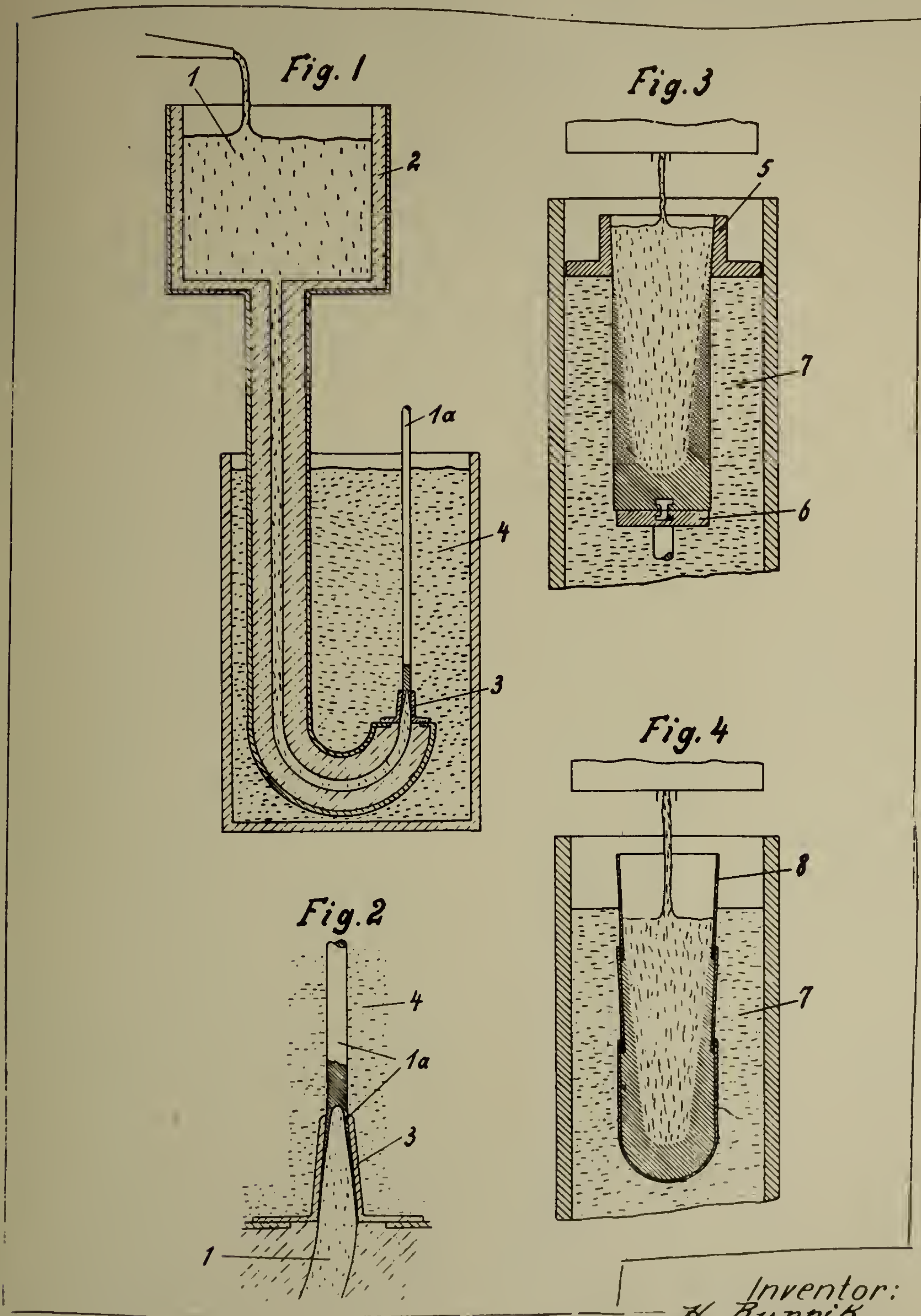

Inventor:
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By: Glascock Downing & Seebold
Attys.

Published June 1, 1943 Serial No. 310,182

ALIEN PROPERTY CUSTODIAN

PROCESS FOR EXTRACTING MAGNESIA FROM WATER CONTAINING CONVERTIBLE MAGNESIUM SALTS, SUCH AS SEA-WATER, ETC.

Jean Charles Seailles, Paris, France; vested in the Alien Property Custodian

No Drawing. Application filed December 20, 1939

Many processes have been proposed for the manufacture of magnesia hydroxide from water containing convertible magnesium salts in solution such as, for example, sea water, natural or artificial brines, etc. Generally milk of lime is used according to the well known reaction.

$$(1)\quad SO^4Mg+MgCl^2+2Ca(OH)^2=SO^4Ca+CaCl^2+2Mg(OH)^2$$

Calcined dolomites have also been used in milk or solid state according to reaction 2 or 3:

$$(2)\quad 2(Ca(OH)^2+Mg(OH)^2)+MgCl^2+SO^4Mg=4Mg(OH)^2+CaCl^2+SO^4Ca$$

$$(3)\quad 2(CaO^1+MgO)+MgCl^2+SO^4Mg=2MgO+2Mg(OH)^2+CaCl^2+SO^4Ca$$

Reaction 3 is obtained when the dolomite has been overburnt so as to avoid hydration of MgO contained in the dolomite.

Unhappily, it is always difficult and often impossible or too expensive to secure lime stones or dolomites pure enough to work under these conditions, because the impurities from these raw materials remain in the recovered magnesia.

It is therefore necessary to locate the works only in favourable sites which limits very much the economical possibilities.

Further, the reactions in the solid state are slow and necessitate expensive working.

The process according to the present invention consists with getting reaction (1) from lime-water instead of milk of lime id est from a liquid reagent.

Under this new condition, all noxious impurities from the calcined lime-stone remain as insoluble residues, and it is possible to use even very impure raw materials and to choose therefore freely suitable manufacturing sites.

It seems however that the process according to the invention is subject to such drawbacks as to render its practical use impossible because lime has a very small solubility in water and huge volumes must therefore be used and also because it is well known by experts that precipitation of magnesium salts solutions by alcaline or alcaline-earth solutions give out precipitates which are very voluminous, difficult to filter and which retain such a quantity of water that they are practically of no possible use.

The inventor has found, by a careful study of these two difficulties, that the first one is not a real difficulty and that the second one can be met with success.

The first point is not a real difficulty because in fact the reaction is very rapid and the cost of pumping and circulating the lyes is a very small item in the total cost price.

Further, the possibility exists to utilize mainly the residual waters from the process for making the necessary lime-water so that pumping be nearly limited to the magnesium salt waters (if local conditions render it useful or necessary).

The second point is solved by precipitating magnesia under special conditions discovered by the inventor which give out a compact and granular material, easy to manipulate and retaining only a normal amount of water.

In fact, if magnesia is precipitated by reaction (1) in a first batch, and if the precipitate, after being separated from the mother-lye, is used as a seed for a new batch and so on, always using the accumulated precipitate from the previous operations as a seed for the next operations, it has been found that (on condition that proper agitation is secured each time during the reaction) the precipitate gets more and more heavy and granular, can be decantated more and more easily and quickly, and retains decreasing quantities of water so that one is perfectly free to regulate, within proper limits, the physical properties of the precipitate. We will now explain the working out of the invention starting for example from sea water and limestone.

The sea water will first, eventually, be purified in known ways from the bicarbonate it contains. It may also be decantated and/or filtered.

From calcined lime-stone, lime-water will, on the other hand, be prepared in fresh water or in residual sea water coming out of the process. In this lime-water noxious impurities are insoluble and soluble impurities are immaterial as they are not precipitated, later on, during the process.

The mixture of the two liquids, sea water and lime-water, in proper proportions give reaction (1) which is practically immediately complete. An excess of one liquid over the other is of no great importance though it is generally better to be slightly short in lime-water. In order to avoid gelatinous precipitates, the reaction is carried as already explained in the presence of an agitated seeding material until the desired quality is obtained. This seeding material may be commercial $Mg(OH)^2$ or $Mg(OH)^2$ produced by the process. For example, suitable seeding precipitate (or a previous precipitate obtained from the process) will be mixed with the sea water or with the lime-stone or with both so that the reaction will take place in the presence of a milk of magnesia-seed well agitated.

It is preferred to mix the seed only to the lime

water and to add progressively sea-water under proper agitation to keep the seed in intimate suspension in the reacting liquid.

It is advantageous to carry the process in a continuous way in a reaction vessel coupled with a decanting tank (or other suitable separating device). In the reaction vessel, lime-water mixed with seeding precipitate, is received, together with sea water, properly dispersed and the liquid is continuously agitated to insure proper and quick mixture.

The proportion between the two entering liquids is easily calculated and controlled by known means.

From the reaction capacity the liquid and the suspended precipitate go together by suitable means (such as pumping or overflow) to the decanting-tank (or any suitable separating device) from which the deposited precipitate is pumped back and reinjected in the fresh lime-water entering the reaction capacity whilst the exhausted water overflows and is taken away.

Working goes on in this way and the precipitate is kept circulating in a closed circuit until its physical qualities are satisfactory. After this point is reached, one may regularly take out for disposal a proper fraction of the circulating precipitate.

It is also possible to work on the batch principle and to dispose of the whole of the precipitate and start again a new series of operations.

In working the process, if the sea water (or the brine containing CO^2) are not chemically treated, the precipitate will contain a small proportion of CO^3Ca which is not detrimental for certain purposes.

However it is generally preferred to treat the sea-water (or brine) in known way by addition of lime or lime-water to precipitate CO^2 as CO^3Ca before using it for magnesia production.

It is also possible to treat the sea water or brine by a strong acid such as for example ClH so as to turn all the carbonates and bicarbonates into soluble salts. Free CO^2 is then separated either by a vacuum or by injecting (or properly mixing with) a gas free from CO^2 (such as decarbonated air).

However a very simple method of manufacture consists with using raw solutions of sea water or brines and to dispose of the CO^3Ca which is precipitated with the magnesia by calcining the mixture and washing out the soluble CaO. In this case, if calcination has been carried at a temperature higher than 1200° C. magnesia does not hydrate to any extent during the washing operation and, after drying, anhydrous magnesia is recovered.

Generally it is preferred but not necessary to carry the different operations so that CO^2 from the atmosphere does not react on the solutions. This may be conveniently realized by using a closed reaction capacity and carrying the decantation under a film of protecting oil.

In certain cases, it may be interesting to utilize dolomite stone for the manufacture of the lime-water used in the process. In this case, magnesia, mixed with the impurities of the raw material is recovered as a residue and this is a second quality stuff which may be used as such or after mixing with the high quality magnesia obtained from the process.

For the manufacture of lime-water, fresh water is preferred if proper supplies are at hand but the exhausted waters from the process may also be used, or mixtures of both. If the sea water or brines contain organic matter in such quantity as to hinder operations, it will be necessary to sterilize it.

As an example, we will now describe the manufacture from sea-water previously filtered on a sand filter.

The lime-water was prepared from fresh water at the start and as seen as the circuit was established, it was obtained from the exhausted sea-water coming out from the reaction. The lime-water was decanted carefully but not filtered.

The proportion of the mixture in the reaction tank was:

	Liters
Sea-water	1
Lime-water	2,4

The liquid from the reaction tank received in the decanting tank was there separated from the precipitate which was continuously reintroduced together with the lime-water in the reaction tank.

Under these conditions, after treating twenty times the initial volume and passing again twenty times the precipitate through the circuit, a production of 2900 milligrams of $Mg(OH)^2$ per liter of sea-water treated was recovered. The precipitate composition (filtered under vacuum) was 53% H^2O and 47% $Mg(OH)^2+CO^3Ca$.

After calcination at 1250° Cent. the material retained 4,8% of CaO and after washing out with fresh water the finished product contained:

	Per cent
MgO	98,8
Impurities	1,2

When manufacturing in the same conditions from sea water previously purified and from filtered lime-water made out of fresh water calcined magnesia retained only 0,5% impurities, without requiring any washing out of CaO.

JEAN CHARLES SÉAILLES.

Published June 1, 1943

Serial No. 312,962

ALIEN PROPERTY CUSTODIAN

PRINTING MACHINE WITH ROTATABLE STENCILS AND AUTOMATIC INK SUPPLY

Robert Koreska, Vienna, Germany; vested in the Alien Property Custodian

Application filed January 8, 1940

For the production of clean and uniform copies by means of printing machines with rotatable stencils the correct inking of the stencils is especially important. Too little ink results in weak copies, too much ink results in visible oil shadows, soaking of ink through the paper to the rear side of the copy, fringed characters and possibility of easily becoming blurred.

The inking was effected up to the present in such a manner that from time to time ink was added arbitrarily by hand. Herefrom results at first an excess in ink which soon becomes a deficiency of ink, especially when large continuous surfaces giving off ink are employed. The copies from one and the same stencil are thus often unequally colored. This irregularity can, however, occur on each copy, for instance with stencils which irregularly consume ink over their width, for which case an additional inking at certain points of the stencils is necessary.

To overcome these inconveniences apparatuses have been built with ink-supply effected permanently or intermittently from the drive, devices being further known which make it possible to supply ink at those points of the stencil at which the ink consumption is higher than at other points. But also these improved apparatus possess still inconveniences which are substantially as follows:

1. The quantity of ink to be automatically supplied must be adjusted and corrected after a certain number of copies have been made. This requires experience and skill and excludes rapid working.

2. The construction of such ink conveying devices is complicated and expensive, especially if the device has to supply ink to only certain portions of the drum.

3. The ink consumption is not economical owing to the still existing irregularities in inking and to the tendency of overinking.

The object of the invention is to obviate these inconveniences by simple means, i. e. by a copying apparatus which, with absolutely automatical inking under economical conditions as regards consumption of ink, time and expenses for the apparatus, supplies absolutely uniform ink copies at any ink consumption of the stencil surface.

This object is attained according to the invention essentially thereby that the ink conveying means of the printing apparatus are of such a character that, during the operation, they supply ink in a larger quantity having a fixed relation to the quantity necessary for the production of a copy, the quantity of ink supplied being preferably in excess, but regularly supplied and regularly discharged, so that a regular ink circulation is produced which regularly supplements the quantity of ink stored in the different parts of the apparatus, such as stencil carrier, felt covering of the drum, ink rubbing mechanism and the like.

The feature of the invention therefore consists in the simultaneous combined employment of a regular ink supply of special kind, of a regular ink removing, and the correct dimensioning of the capability to store ink of the elements of the printing machine which take up the ink, and in maintaining constant this quantity of stored ink.

Compared with the automatic devices of known type for supplying ink, the ink according to the invention is supplied in comparatively considerable quantities and without the necessity to regulate the quantity accurately in accordance with the consumption of the printing mechanism, this being possible with the aid of technically simple means, because the accurate subdivision into predetermined and very small ink quantities is no longer necessary. As the ink is supplied in excess, absolutely taken in a large quantity which technically can be easily handled, also the discharge of the excess is made in larger quantities which technically can be more easily governed. The maintaining of a certain quantity of ink in the printing apparatus is ensured thereby that the circulating ink quantity is regularly offered to the elements which store up the quantity of ink necessary for the work, so that, by corresponding selection of the capability for storing ink, the quantity of ink is always present which is necessary for the production of the best copies.

The intended success occurs only if all these preliminary conditions are fulfilled. The regular automatic ink supply alone would lead to damming up the ink, whereas the automatic ink discharge without simultaneous regular admission would also lead to the disagreeable ink excess or lack of ink, and it has been found that these inconveniences cannot be overcome thereby that the capability of the apparatus to store ink is increased or decreased if the ink supply alone or its discharge alone takes place regularly. For the object of the invention it is material, that a continuous regular flow of ink through the apparatus is ensured, a certain quantity of ink being permanently maintained owing to the correct measure of storing capability of the ele-

ments of the apparatus which store ink. If these conditions are fulfilled, the surprising effect is obtained that excellent copies of greatest uniformity can be obtained even if the ink consumption of a stencil considerably varies over the width of the same. This means, however, that such apparatus does not require the expensive auxiliary means for enabling the ink supply at certain points of the stencil.

Printing apparatus with one printing drum have already become known, in which a permanent discharge of ink in excess is carried through by a scraper. In such apparatus the ink supply is, however, effected only temporarily by hand, i. e. arbitrarily and irregularly, so that the effects according to the invention cannot occur for this reason alone, the importance of a continuous regular ink flow through the apparatus with maintainance of a certain quantity of ink in the apparatus having up to the present not yet been recognised.

Experiments will show which quantities are required in every instance on the one hand for the circulating ink and on the other hand for the ink stored in the apparatus. These quantities depend on the efficiency of the printing machine, on its size, the number of drums, the physical properties of the ink (composition, density and the like) and other requirements of every individual case. Either a certain smaller quantity of ink can be continually admitted, distributed and discharged again (which means a continuous ink circulation) or a certain subdivision may be made in such a manner that the ink is admitted, after a certain number of rotations of the roll, or after the production of a number of copies, jerkwise but automatically, whereupon the ink supply has to be stopped for a certain time. Also the taking off of ink can be carried out accordingly. In any case the ink supply and discharge is regular and automatic, so that a continuity in the ink circulation is ensured which ensures a uniformly large quantity of ink, i. e. that quantity which must always be at disposal in the apparatus for the direct inking of the stencils, and therefore a great uniformity of the copies with absolutely automatic operation.

Several embodiments of the invention are illustrated by way of example in the accompanying drawing, in which

Fig. 1 shows the application of the invention to a single drum,

Figs. 2 and 3 shows the application of the invention to a two-drum rotary stencil printing apparatus.

The stencil cylinder 1 is mounted at 2 and 3 on a stationary shaft 4 and driven by means of a crank handle 6 or by motor through the intermediary of a spur wheel 5. If the cylinder 1 rotates, also an inner spur wheel 8 and another spur wheel 9 in the cylinder rotate. On the shaft of spur wheel 9, the shaft being mounted by means of stays on the shaft 4, one or several cams 10 are arranged which control the ink supply from a container 12 by opening the valves 11. By suitable construction of the cams and by selection of the ratio of transmission of 8 and 9 it is attained that the cams regularly open the valves 11 for a certain time after a more or less great number of revolutions of drum 1, and consequently the ink moistens the interior of the perforated cylinder and effects the inking of the stencil. The ink is then, by rotation of the stencil cylinder 1, brought to in front of the scraper 13 which scrapes off the inner surface of the drum and again conveys the excess ink into the container 12. In this manner a continuous ink circulation is attained and at any time the correct quantity of ink necessary for the operation is stored in the apparatus; a quantity of ink large as compared with the ink consumption is permanently or regularly held in movement in the apparatus according to the invention and employed for the continuous completion of the ink quantity for the service.

In the form of construction shown in Fig. 3 is 13 the upper drum and 14 the lower drum, a stencil carrier 15 being wound around these drums. A rubbing roller is designated by 16. An additional roller 17 is pressed by means of a spring 18 against the drum 13 and rotates in a vessel 19. This vessel 19 is filled with ink. If therefore the upper drum 13 revolves in the direction of the arrow *a*. the roller 17 is positively drawn along by friction in the direction of the arrow *b*, so that the ink is supplied on to the circumference of drum 13 and rubbed by the roller 16. The ink then gets from below on to the stencil carrier 15 and inks the stencil through this carrier. The ink which is not consumed is brought to in front of the roll 17 which acts as damming element and causes the flowing off of the ink in excess.

The roll 17 allows only a predetermined quantity of ink to pass through between itself and the drum 13. With this object in view the roll 17 must be strongly pressed against the drum 13. Only a very little portion of the ink taken from the container 19 is therefore conveyed; the larger portion is dammed up in front of the gap between the two elements and flows back into the container. Addition means for taking off the ink can evidently also be provided, but the arrangement as described operates absolutely satisfactorily.

If the quantity of ink, which has to pass through between the roll 17 and drum 13, has to be altered, this may be effected either by making the roll 17 of a larger diameter or thereby that, by giving to the auxiliary roller 17 a certain cross-section, the gap 20 is enlarged, which in total results in a certain passage cross-section.

The space which serves for accommodating the ink container 19 (Figs. 2 and 3) is restricted. The container 19 can be lengthened in outward direction and widened to a trough. As it has shown to be suitable to leave the ink in container 19 always at the same level, a tank 20 for ink or any other ink discharge pipe may dip with its downwardly directed discharge aperture into the trough so that according to the well known physical principle, the height of the ink level in the trough remains always the same.

The ink circulation can be effected directly by the driving mechanism of the apparatus or by a separate device, for instance a small size ink conveying pump. This pump can present the ink for instance directly or indirectly to the element controlling the circulating quantity, for instance to the cylinder 17 as shown in Fig. 3, or in case the operation has to be carried out with sufficiently large excess, without intermediate elements after the manner of the roll 17.

ROBERT KORESKA.

PUBLISHED

JUNE 1, 1943.

BY A. P. C.

R. KORESKA

PRINTING MACHINE WITH ROTATABLE STENCILS
AND AUTOMATIC INK SUPPLY

Filed Jan. 8, 1940

Serial No. 312,962

Fig.1

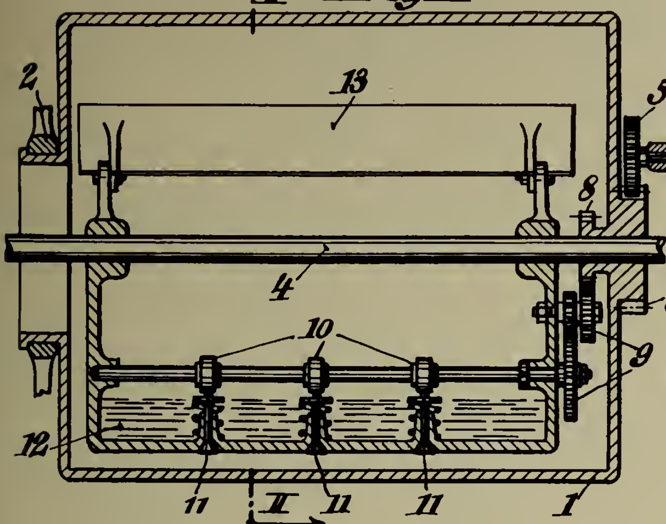


Fig.3

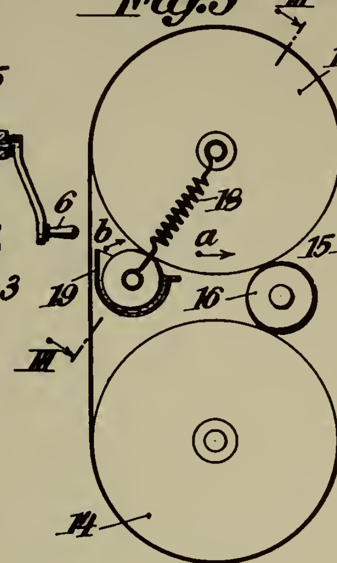


Fig.2

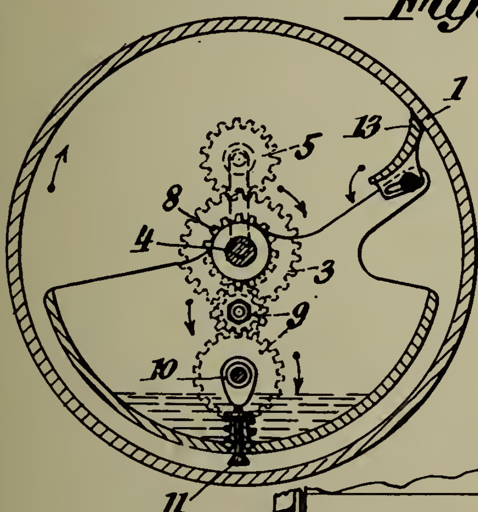
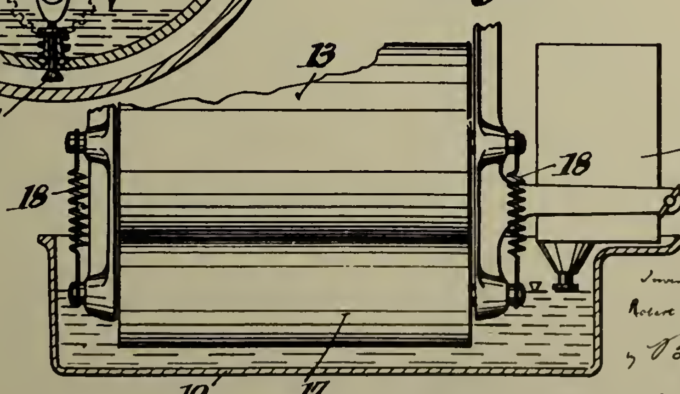


Fig.4



Inventor.

Robert Koreska

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ALIEN PROPERTY CUSTODIAN

DEVICE FOR THE DISTRIBUTION OF STOCK ON THE WIRE PART OF A PAPERMAKING MACHINE

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Application filed January 8, 1940

The present invention relates to an improved method of and means for the manufacture of paper.

In paper making machines it has been usual to project a layer of stock or paper pulp upon one end of an endless moving band of wire gauze through an opening, sometimes termed a slice, which is adjustable in depth and which is disposed immediately above the travelling endless wire gauze belt; the speed of delivery of the pulp or stock has usually been adjusted to be substantially that of the linear speed of the travelling wire gauze conveyor.

The paper made in this manner has a much lower transverse resistance than its longitudinal resistance. This is due to the fact that under the effect of passing through the distributing slice, the majority of the fibres in the stock are set in the longitudinal direction.

A paper of this kind is suitable for newsprint since it has to withstand comparatively high longitudinal pulls in the rotative printing machine.

For all other applications however, this will be a drawback since such paper has not the nice aspect of a paper, the fibres of which are arranged along all possible directions, it will further not remain flat after slight absorption of humidity, and lastly, for an application necessitating a paper of given resistance, it will be necessary to choose a sheet having the desired resistance in the transverse direction, therefore of a greater thickness as would be necessary if the resistance were the same in all directions.

In the absence of precautionary measures, difficulties moreover would be present in the distribution of the stock to obtain a layer of pulp of uniform thickness from one side of the wire band conveyor to the other, and if the stock is being delivered at high speed there is a tendency for the stream to carry air bubbles with it, retarding the drainage of the paper stock on the wire band and resulting in a badly felted and cloudy sheet.

An endeavour has been made to remedy these drawbacks and to criss-cross the fibres by subjecting the wire to a rapid shaking motion in the transverse direction, the amplitude of the shake being 4 to 12 mm. and the number of shakes 150 to 400 per minute, but this results in a serious complication of the machine, while the desired effect is far from being attained since the transverse resistance of the paper will, even in this case, only amount to 50–60% of the longitudinal resistance.

An object of the present invention is to render a machine capable of manufacture of a greater variety of paper, whilst another object is to provide means whereby the distribution of fibre in the stock or pulp stream reaching the wire band conveyor can be under control; a further object is to provide means whereby air bubbles carried along with the pulp stream can be released.

According to the present invention paper pulp or stock under a dynamic or static head, that is to say fed by a pump or alternatively by gravity from a tank, passes from a slice or outlet onto a travelling woven wire band or conveyor. The direction of flow of the paper stock is altered between the point where it leaves the said slice and the place where it reaches the wire band conveyor.

It will be preferred that the direction of flow be altered smoothly and constantly.

In certain cases it may be desirable to deviate the direction of flow of the paper stock on leaving the slice in one direction, and then to turn it smoothly into the opposite direction prior to its arrival upon the wire band or the like conveyor.

The invention is more particularly described with reference to the accompanying drawings in which:

Figure 1 is a sectional elevation of one end of a paper making machine showing the outlet mouth or slice of the present invention.

Figure 2 shows an alternative form of outlet mouth or slice.

Figure 3 is a side elevation of a further form of construction, in which the position of the outlet mouth is adjustable.

Figure 4 is a corresponding plan view.

Figure 5 is a detail showing another form of construction.

Figures 6 and 7 show in side elevation further alternative forms of construction.

In the arrangement shown in Figures 1 and 2, the pulp coming from the screens is either fed to the collecting pipe **1** by a pump of constant delivery and pressure, or is fed to a reservoir **2** in which the head is adjustable, to give a static head of pulp, so as in each case to obtain an outlet speed of the pulp which approximates to the speed of travel of the wire band conveyor **14**.

The pulp will therefore be fed by a dynamic or static head to a distributor **3** either through flexible pipe connections **4**, or through a rectangular opening at the bottom of the reservoir **2**. The pipes **4** may be replaced by a single rectangular conduit.

A perforated cylinder **5** of known type is placed close to the outlet opening of the distributor in order to even out the distribution and to prevent the possible accumulation of fibres in bundles.

The outlet spout or slice of the distributor 3 is formed by the fixed wall 7 and an adjustable lip 8. The adjustment of the lip 8 is controlled by a hand-wheel 9, operating worm gears 10, which adjust the angular position of the supporting arms 11 of the transverse shaft 12, these arms being positively connected to the lip 8 by a number of hand screws 13 by which the depth of opening at different points across the outlet can be adjusted to maintain the flow even across this width.

With the above mechanism, it is therefore possible to adjust the depth of the outlet spout the full width of the wire, which might be necessary due to an uneven arrival of the pulp stream on the wire band, and in order to obtain a regular depth of the pulp on the full width of the wire 14.

At the outlet spout 6, the pulp enters the downward directed and rapidly curved flow plate 15. In order to reduce friction between the fibres and the flow plate 15, a film of water is introduced through the narrow opening 16, between this flow plate and the layer of pulp, this opening extending over the whole length of the distributor 3.

As the pulp approaches the outlet spout 6, its speed increases considerably and due to this the fibres will progressively be aligned in the direction of the pulp stream. The speed is still further increased by the gravity fall over the flow plate, so that the fibres, when the pulp reaches the wire 14, are mostly all arranged in the direction of travel of the wire. As a consequence of the speed and the rapid curve of the flow plate 15, the pulp will be subjected to centrifugal force.

As the pulp is very turbulent when leaving the outlet spout 6, it has a tendency to take up air, which is undesirable for the formation of the sheet, but by reason of the centrifugal action imposed on the pulp in passing over the flow plate 15, the air bubbles will burst and leave the pulp.

When arriving on the wire, the majority of the fibres will take up a longitudinal direction as a consequence of the increase in speed of the pulp in passing through the distributor 3 and in running down the flow plate 15 and the paper obtained will therefore show a much higher strength in the running direction than in the transverse direction of the wire 14; the paper obtained will be consequently particularly suitable for newsprint, as this paper has to withstand comparatively high longitudinal draws in passing through the rotary printing machines.

In order to increase the gravity fall effect, the slope 15 may be extended as shown on Figure 2, where the pulp leaving the distributor 17 is obliged to follow the flow plate 18, and then follow a second flow plate 19 before arriving on the wire 14.

The distributor 3 may be provided with means to adjust it angularly relatively to the centre of the roll supporting the wire, so that the amount of gravity fall of the pulp can be adjusted.

In Figures 3 and 4 the pulp is fed through the flexible pipe connections 4 and enters the distributor 20 where it is baffled by the partition 21, which causes the pulp to spread out transversely. The usual perforated cylinder 5 is provided to even out the distribution and to prevent bunching of the fibres.

The outlet spout 6 of the distributor 20 is formed by the fixed wall 22 and the adjustable lip 8. The adjustment of the lip 8 is controlled by a hand wheel 23, moving worm gears 24, which adjust the angular position of the transverse shaft 25. On this shaft is fixed a series of eccentrics 26 which, by the rotation of the shaft 25, will move forwards or backwards the connecting rods 27, which, with the help of the levers 28, will control the lip 8 and adjust the outlet spout 6. The hand wheels 29, of which a number are provided across the width of the outlet spout, serve to adjust the depth of this spout at various points across its width.

Leaving the outlet spout 6, the layer of pulp enters the curved flow plate 30, where it will even out in thickness on the whole transverse width under the influence of centrifugal force, which force will also tend to provoke the bursting of air bubbles which may become mixed with the pulp by the turbulent outflow from the outlet spout 6.

A film of water is introduced between the layer of pulp and the flow plates through the narrow opening 16, thus avoiding friction between the fibres and the flow plates.

Leaving the downward directed and curved flow plate 30, the pulp comes upon another flow plate 31, which is directed upwardly towards the wire 14. On this latter flow plate, the pulp stream will be slowed down, which effect results in a thorough mixing of the pulp and causes the fibres to be arranged in all directions.

The distributor 20 is provided with journals 32, resting in the supports 33. A hand wheel 34 controlling worm gears 35 enables the distributor to rotate around the axis of the journals 32 to a desired position, so that length of flow of pulp over the flow plate 31 can be adjusted as desired and thereby the degree of distribution of the fibres laterally of the direction of flow.

The distributor 20 may also be brought nearer to or farther away from the flow plate 31 by means of the adjusting nuts 36.

The lever arms 37 fixed on the shaft 38, which may be rotated by worm gears 39 by means of the handwheel 40 and the intermediate gears 41, will enable the distributor 20 to be placed in any position between the extreme positions A and B.

When the distributor 20 is placed in the position A, a paper with a maximum strength in the direction of travel of the wire will be obtained, and when it is placed in the position B, the paper obtained will have its maximum strength in a direction transverse to the direction of travel of the wire.

The flow plate 31 is fixed to two or several frames 42.

In order to simplify its construction, the form of the flow plate is shown cylindrical, but it may have other shapes, in which case the distributor 20 is displaceable in guides of the same contour as the flow plate.

By a suitable adjustment of the distributor 20, it is even possible for the pulp jet to arrive on the wire without passing over any part of the flow plate 31.

For slow speed machines the flow plate 30 may be eliminated and the distributor may be constructed as at 49, Figure 3. In this distributor, the partition 50 will compel the pulp to spread out in the transverse direction. A perforated cylinder 5 may or may not be used in the distributor 49.

With present types of paper making machine when it is desired to adjust the width of the sheet, it is either necessary to stop the machine, resulting in a loss of output, or to trim-off a strip on either side of the sheet at the couch roll in order to obtain the desired width of finished paper web. At the couch roll, however, the pulp is dewatered and consequently the trimmed-off

strip requires treatment by independent equipment to render it a density suitable for it to again mix with the pulp stream.

The arrangement of Figures 3 and 5 show a means by which the sheet width can be adjusted whilst the wire is running and the eliminated pulp strips, whilst still in a liquid state, can be returned directly to the pulp coming along through the flexible pipe connections **4**. To arrive at this result, two side frames **43** are provided to limit the width of the sheet, one on each side of the wire. Those side frames may be adjusted in the transverse direction by any desired means. The maximum width of the sheet is indicated by C and the minimum width by D.

The edges **44** of the side frames **43** will divide the layer of pulp into three parts, the central part of which follows the wire. The two side portions will contact with the plates **45**, which compel the pulp to follow the channels **46** to arrive finally into the gutter **47**. From this, the pulp will travel through the pipe **48** to arrive in a reservoir, where it is mixed with the pulp fed to the distributor **20**.

Figure 6 shows the same arrangement as Figures 3 and 5, with the difference that the flexible pipe connections **4** are replaced by fixed pipe connections.

The pulp is fed by a constant delivery and pressure pump or from a reservoir with a constant head, through the pipe **51**, from which it is distributed to the pipes **52**, which terminate in the swivel joints **53**. The pulp then enters into two other pipes **54**, through which it arrives at the distributor **20**, passing through the two tapered mouthpieces **55**. The lower extremities **56** of the pipes **54** are fixed to the extremities of the shaft **38**, by couplings **57**, the shaft **38** adjusting the position of the distributor **20** along the flow plate **31**, being jointed to the pipes **54** which feed the pulp to the distributor, and connected to the pipes **52**, in fixed position, by the swivel joints **53**.

The pipes **54**, being slightly flexible metal, will permit of a small degree of adjustment of the distributor **20**, by means of the nuts **36** and the worm gears **35**.

Figure 7 shows an arrangement of pulp distribution with downward and upward directed flow plates in a fixed position.

The pulp is fed to the distributor **58** through the flexible pipe connections **4** or through a single inlet extending over the whole width of the distributor. In passing into the distributor, the pulp will be baffled against the partition **59**, which will force it to spread out transversely in the distributor **58**. A perforated cylinder **5** evens out the distribution and prevents the bunching of the fibres.

The outlet spout or slice **6** is formed by the fixed wall **60** and an adjustable lip **8**.

The adjustment of the lip **8** is controlled by the handwheel **9** through worm gear **10**, which adjusts the angular position of the supporting arms **11** of the transverse shaft **12**, these arms being firmly connected to the lip **8** by a number of individually adjustable hand screws, by which the depth of opening of the outlet spout **6** at any point from one edge to the other across the width of the spout can be adjusted.

Leaving the outlet spout **6** the pulp is downwardly directed on to the rapidly curved flow plate **61**.

In order to avoid friction between the fibres and the flow plate, a film of water is introduced between this flow plate and the layer of pulp through the narrow opening **16**, which extends over the whole width of the distributor **58**.

As a consequence of the increased speed of flow due to gravity and to the rapid curving of the flow plate **61**, the pulp will be subjected to strong centrifugal action and will even out, so that the thickness of the layer of pulp will be the same on the whole width of the flow plate permitting a sheet of regular thickness to be obtained on the wire, and air bubbles will burst and leave the pulp.

After having gone over the downward directed flow plate **61**, the pulp flows on to the upwardly directed flow plate **62**. On this flow plate, the pulp stream will slow down, which results in a thorough mixing of the pulp, the fibres being arranged in all directions. As a result, a paper will be obtained of a transverse strength about equal to its strength in the direction of flow of the pulp stream.

The width of the sheet on the wire may be adjusted whilst the machine is running, with the help of the side frames **63**, which may be moved in the transverse direction by the screwed rods **64**. Each one of the side frames **63** is provided on the outside and immediately against the outlet spout **6** with a gutter **66**, provided with an outlet pipe **67**, which communicates with a recipient **47**, from which the pulp flows by the pipe **48**.

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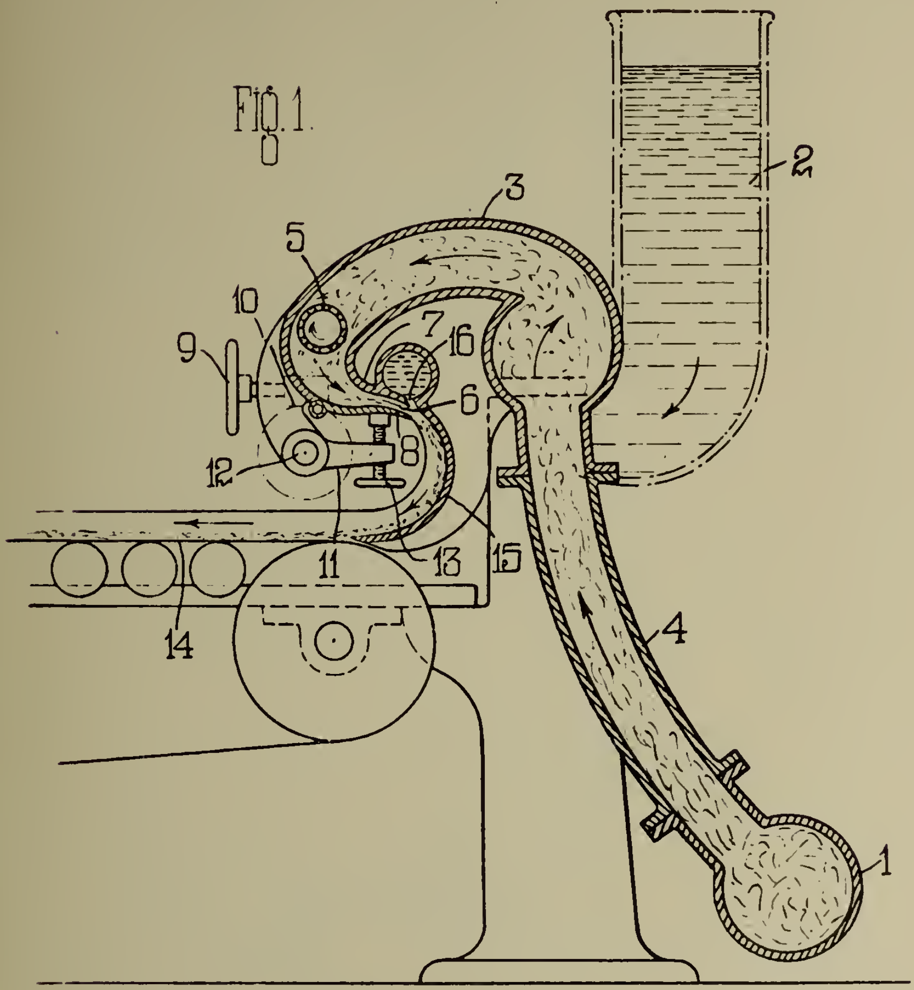
DEVICE FOR DISTRIBUTION OF STOCK ON THE WIRE PART OF A PAPERMAKING MACHINE

Filed Jan. 8, 1940

Serial No. 312,989

5 Sheets-Sheet 1

Fig.1.



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5 Sheets-Sheet 2

Fig. 3.

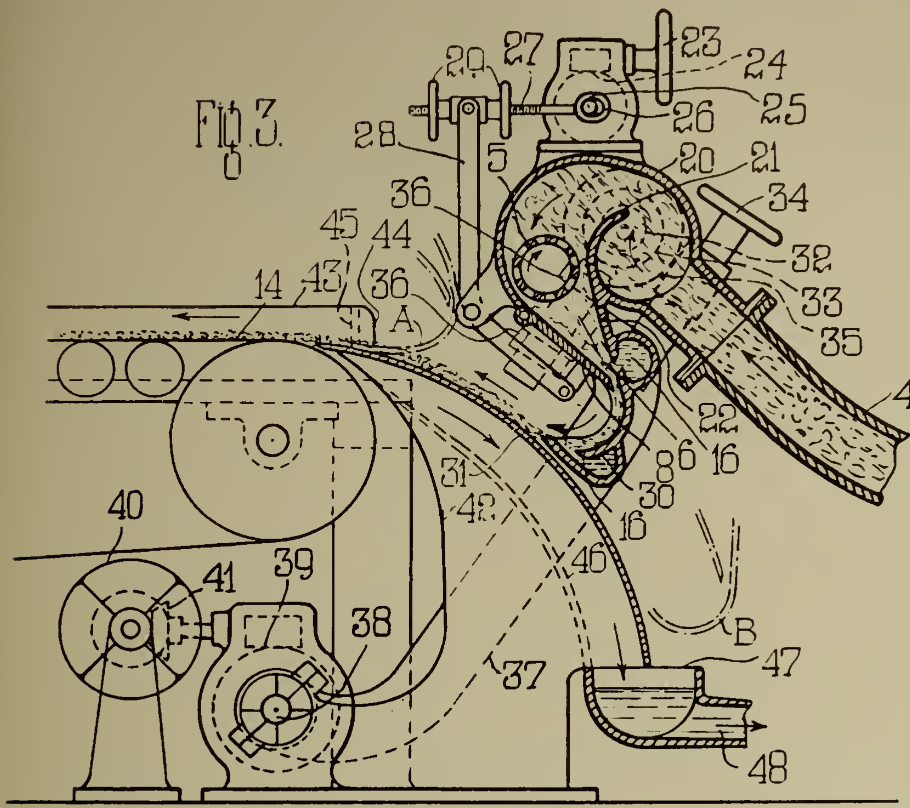
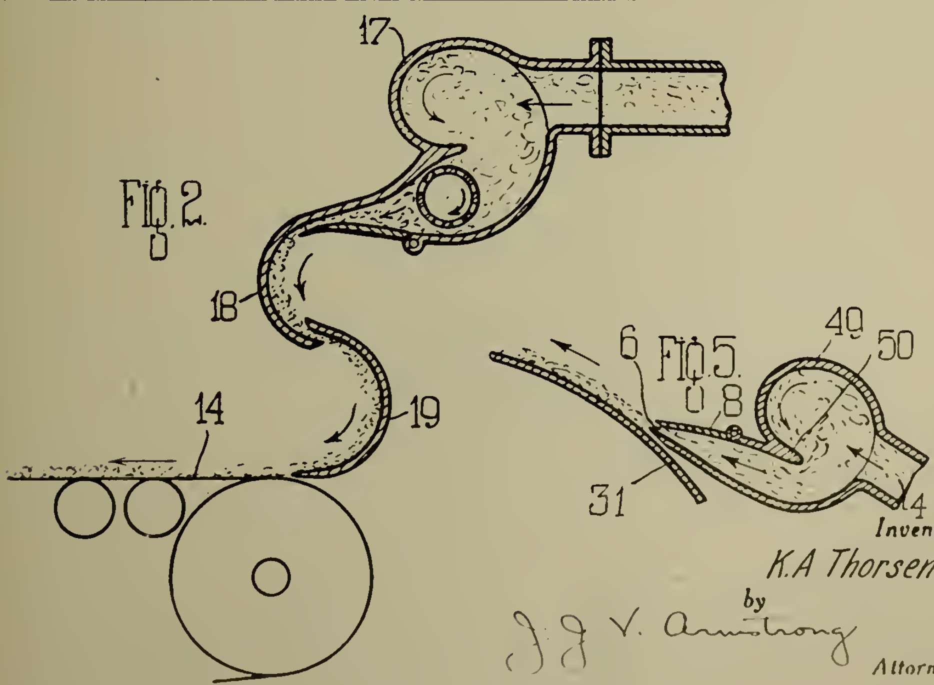


Fig. 2.

Fig. 5.



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DEVICE FOR DISTRIBUTION OF STOCK ON THE WIRE PART OF A PAPERMAKING MACHINE

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5 Sheets-Sheet 3

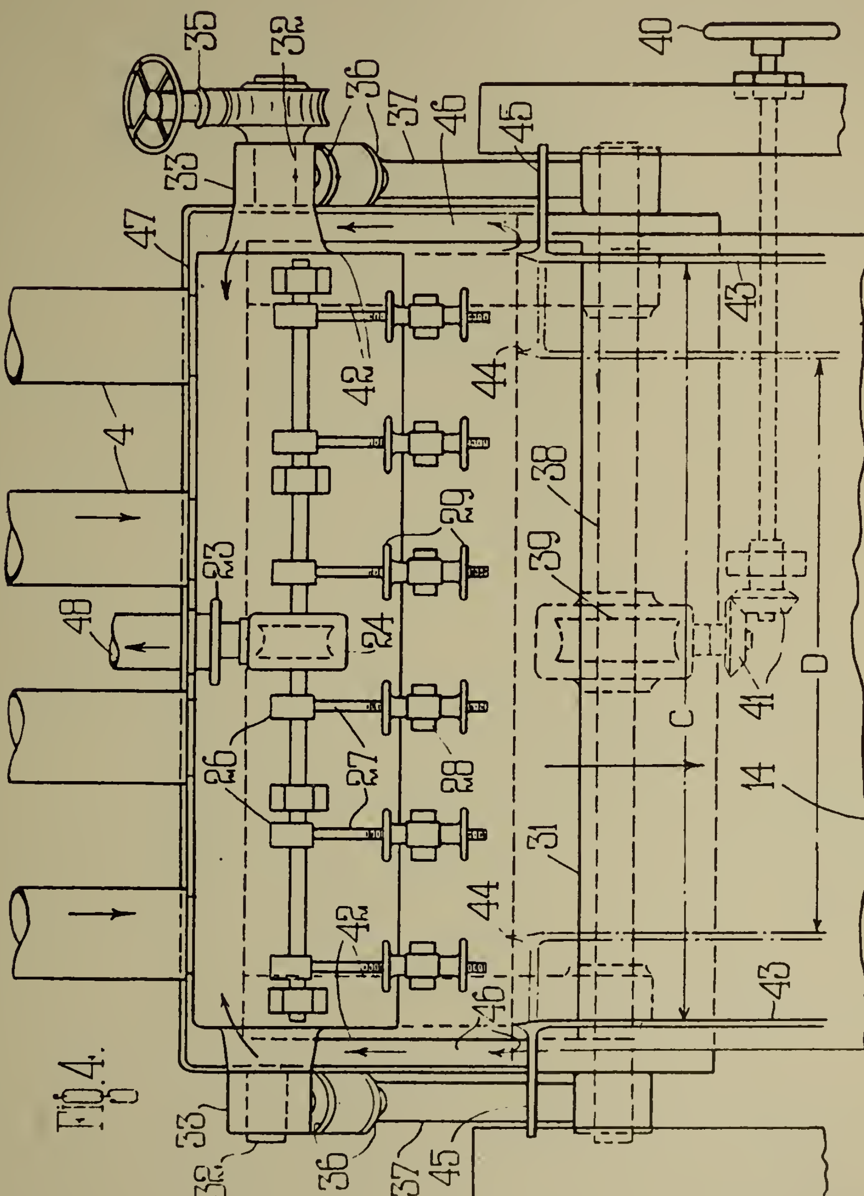

Fig. 4.

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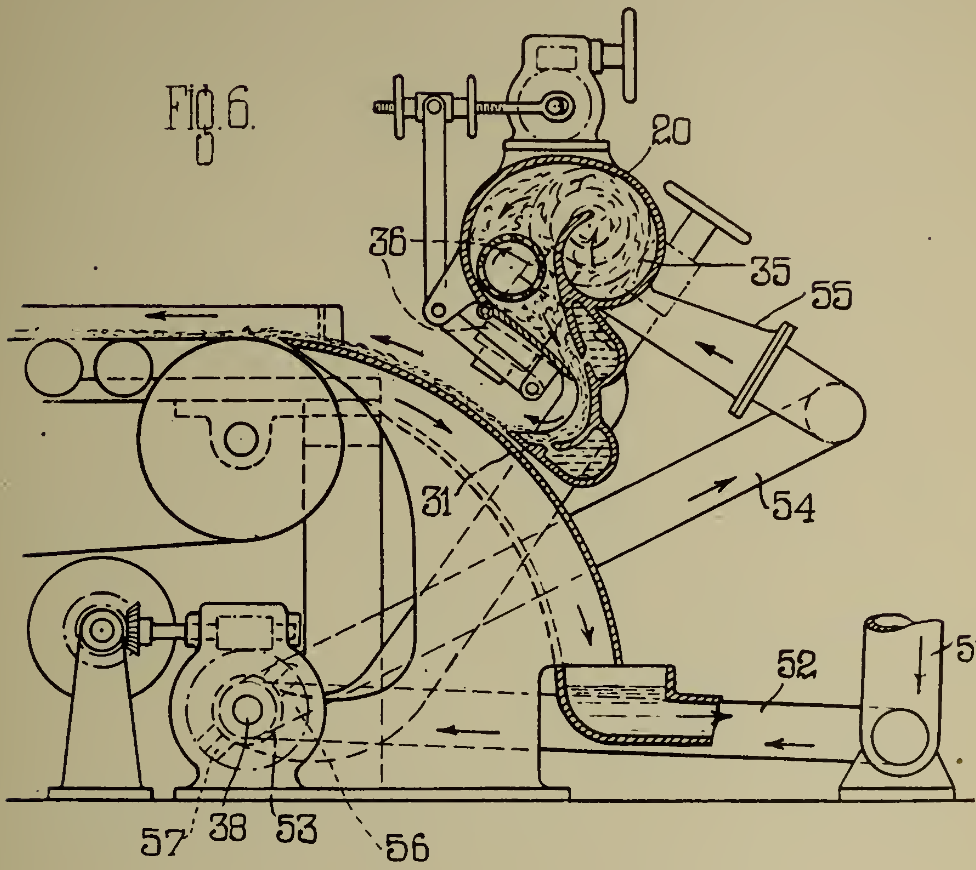
5 Sheets-Sheet 4

Fig. 6.



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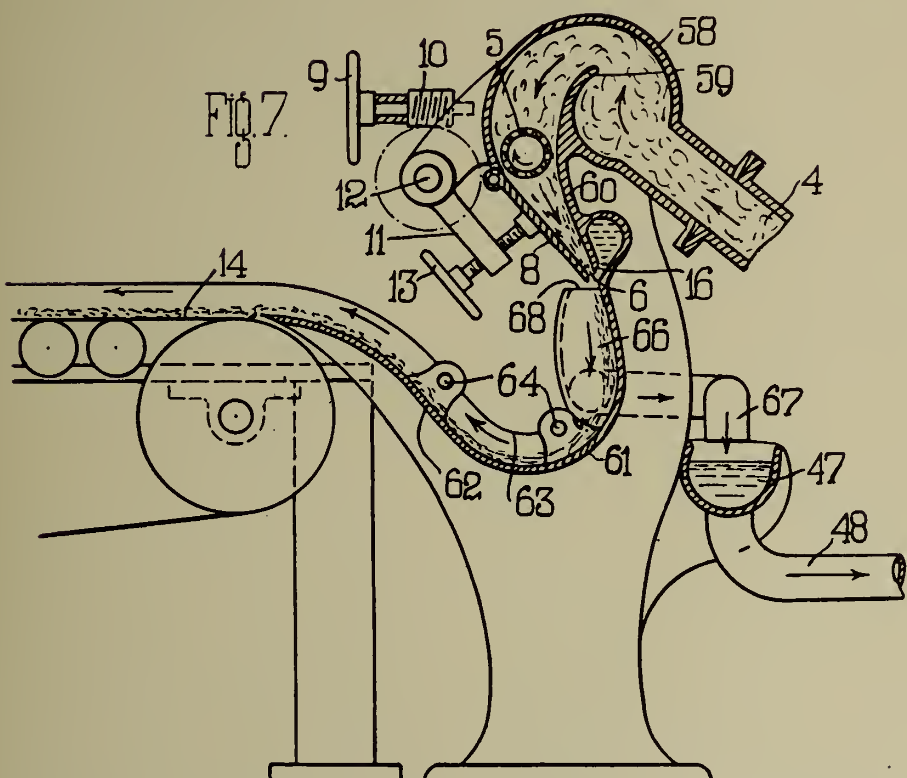
5 Sheets-Sheet 5

Fig. 7.



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ALIEN PROPERTY CUSTODIAN

PROCESS AND DEVICE FOR THE MANUFACTURE OF MOULDED OBJECTS OF A CELLULAR, RUBBER-LIKE SUBSTANCE HAVING CLOSED, GAS-TIGHT CELLS FILLED WITH GAS, PARTICULARLY OF CELLULAR EBONITE

Marie Charles Léon Ricard, Paris, France; vested in the Alien Property Custodian

Application filed January 17, 1940

The present invention relates to a process and to a device for the manufacture of moulded objects of a cellular, rubber-like substance with closed, gas-tight cells filled with gas, particularly of cellulose ebonite. It is known that the cellular substances with gas-tight cells, particularly multicellular rubber and ebonite, are manufactured from a mass of crude rubber subjected first to a prevulcanisation treatment under a high gas pressure, which gas may penetrate into the mass, and then, after a free or controlled expansion of the prevulcanised mass into which the gas has penetrated, to a final vulcanisation treatment, the degree of which depends upon the nature of the product it is desired to obtain: cellular rubber or cellular ebonite.

According to a known process, permitting the manufacture of plates and of small objects, the mixture of crude rubber is brought in the form of a long plate which is rolled up in a spiral together with strips of sheet metal and paper, or it is brought in the form of small masses which are introduced into a pulverulent substance contained in not gas-tight moulds, that are placed into a vessel fitted with a gas-tight closing, acting both as an autoclave and a gasification chamber into which is introduced the gas under pressure and which is then heated. When the gas under pressure has diffused through the mass of crude rubber and the latter has been prevulcanised to a sufficient degree for retaining the gas, the rolls or the moulds are taken out of the autoclave and unrolled or opened; the rubber masses are freely expanded and then subjected to a final vulcanisation either in the free state or in a finishing mould.

According to another process, the gasification, the prevulcanisation the expansion and the final vulcanisation of a moulded object are carried out in one single mould which is not gas-tight, the various moulds being placed inside an autoclave into which the gas is introduced either in the gaseous form or, before heating the autoclave, in the form of a liquid or a solid.

Both these processes however, present the drawback of being long and costly owing to the long time of heating and the great amount of heat which are required for bringing to the desired temperature the high pressure autoclave vessel that may be heated only from the outside and whose walls are very thick. The cooling down, likewise, demands a considerable amount of time.

In the second process, this drawback is further enlarged, in spite of the apparent simplification of the process, by the inefficient use of the useful volume of the high pressure autoclave vessel, due to the presence of individual moulds, the dimensions of which must correspond to the final dimensions, after expansion, of the objects to be manufactured. For this reason, the process has not received up to the present any practical applications.

The process according to the present invention has the object to remedy these drawbacks in order to permit effecting all the operations of treating the mass in the same mould, and it is characterized by the fact that the treatment is effected in gas-tight, individual moulds directly connected to a supply of gas under pressure, serving simultaneously as autoclaves and as shaping moulds.

According to an embodiment of the invention, the gas-tight moulds are held clamped during the treatment between the heating plates of a hydraulic press or between the plates of an autoclave press. However, the said moulds may also comprise closing means and be heated electrically or by circulation of steam through channels suitably provided in their mass.

By way of example, there has been described below an embodiment of the process object of the invention, with reference to the annxed drawing representing diagrammatically a device for carrying the process into practice.

The device represented on the drawing by way of example concerns the manufacture of spherical objects of gas-tight multicellular ebonite. The device comprises a number of individual moulds, such as **1**, arranged between the heating plates **2**, **3** of a hydraulic press in which are provided channels **4**, **4'**, . . . for the circulation of steam, the arrangement being thermically isolated by means of heat insulating panels **5**, **6**. Each mould is constructed in two pieces assembled by means of an arrangement **7** comprising a gas-tight fitting joint **8**, preferably in graphited asbestos, which is strongly compressed and crushed at the joint, the total force of the press being to this effect made higher than the maximum forces exerted by the gas inside the moulds, in order to provide a clamping pressure of the order of 5 to 10 kg/sq cm upon the surface of the joints. Each of these gas-tight moulds is provided with a bore **9** connected to a piping **10** which is in turn connected through a sectioning valve **11** to a supply **12** of gas under high pressure. The inner surface of the mould is prefer-

ably silicated for preventing the sticking of the treated mass.

The mass of crude rubber to be treated is introduced into the mould under the form of a spherical rough cast 13, preferably separated into a number of slices or portions not sprayed with talc, replaced together, in order to facilitate the penetration of the gas, and occupying, in the case of ebonite, about one twelfth of the inner volume of the mould 1 which corresponds to the final product to be obtained. A gas will preferably be used, which is inert under the treating conditions and which has a high capacity of penetration and diffusion through the rubber, as for instance carbon dioxide, this permitting the use of comparatively low gas pressures and therefore the reduction of the force required upon the press.

After the roughs have been introduced into the cold moulds, the latter are placed in the press and filled, by suitable operation of the valve 11, with cold carbon dioxide under a pressure of the order of 35 kg/sq cm. The valve is then closed again and the plates of the press heated. The moulds, and consequently the roughs, are not cooled down between the phase of prevulcanisation under pressure and the final vulcanisation stage, and a very short time interval separates these operations from one another; the result is that the prevulcanized mass at high pressure need not retain for a long time (before the final vulcanisation) the gas which it maintains emprisoned, so that the degree of prevulcanisation may be substantially less than in the usual process. Thus, it will generally suffice to heat the device up to 100° and maintain it at this temperature for about one hour and a half, after which time the rough will be brought, owing to its comparatively small dimensions, to a uniform temperature. Due to this comparatively short duration which is sufficient for a correct penetration of the heat into the innermost of the mass, there will be taken a rubber blend which is more accelerated, i. e. which will vulcanise more rapidly, than that used in the usual process. In any case, the temperature must not attain a value for which the pressure of the gas retained in the gas-tight mould would be higher than a figure of the order of 60 kg/sq cm, which is sufficient for producing the solution of the carbon dioxide in the rubber.

The prevulcanisation and the injection of gas having thus been effected, the valve 11 will be opened without stopping the heating, for evacuating the gas until the pressure inside the mould has been brought down to atmospheric, in order to permit the rough 13 to expand under the action of the contained gas and to fill up the mould entirely. The temperature is then gradually increased up to about 150° and maintained at this value during about one hour, after which the mould is allowed to cool down for half an hour and the rubber piece taken out of the mould. All the operations permitting the manufacture of multicellular ebonite by the process according to the invention have therefore only a duration of three hours as a whole, thereby reducing to a great extent the cost price of the product without in any way altering its quality.

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BY A. P. C.

M. C. L. RICARD

PROCESS AND DEVICE FOR THE MANUFACTURE OF MOULDED OBJECTS OF A CELLULAR, RUBBER-LIKE SUBSTANCE HAVING CLOSED, GAS-TIGHT CELLS FILLED WITH GAS, PARTICULARLY OF CELLULAR EBONITE

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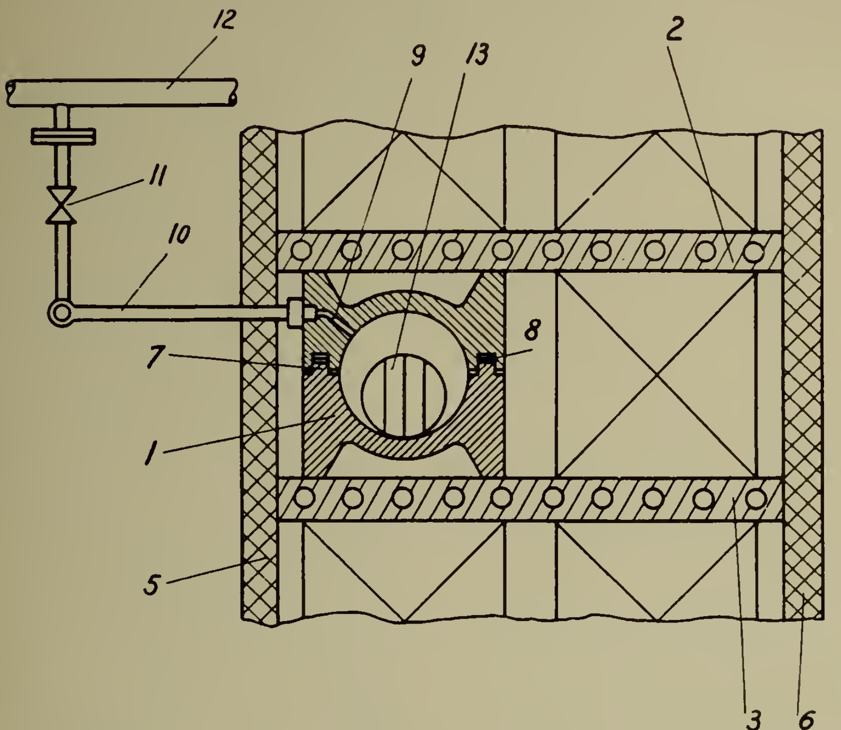

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ALIEN PROPERTY CUSTODIAN

CONTROLLING OR REGULATING DEVICE FOR INTERNAL COMBUSTION ENGINES

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Application filed January 26, 1940

This invention relates to improvements in or relating to controlling or regulating devices for internal combustion engines of the kind in which an air quantity regulating element and a fuel regulating element are provided for controlling the air supply and the fuel feed, respectively.

The invention aims at providing means for controlling the pressure drop determining the inflowing air quantity regardless of any pressure fluctuation in the intake conduit resulting from pressure fluctuations in the combustion chamber of the engine.

A further object of the invention is to provide means for simultaneously adjusting the air controlling element and the fuel controlling element and for maintaining a constant pressure drop at said air element as well as at said fuel element. In this way the position of the air element and of the fuel element, respectively, is proportional to the amount of air or fuel flowing in.

Another object of my invention is to provide means for the avoidance of an overcharging of the engine as soon as the air controlling element reaches its terminal open position.

Other aims, advantages and objects of my invention will now be more fully explained with reference to the accompanying drawings, in which

Fig. 1 is a sectional view of one embodiment of the invention comprising an air controlling element and a throttling member in the air intake conduit;

Fig. 2 is a sectional view showing another embodiment comprising only one throttling member in the air intake conduit, and

Fig. 3 shows a detail of the embodiment according to Fig. 2.

In controlling or regulating devices it is important that the air and fuel elements be so adjusted that the air quantity and the fuel quantity are correlated at all engine loads in order to ensure an economic operation of the engine. To this end it does not suffice to positively couple the air member and the fuel member so as to ensure a simultaneous adjustment of both said members. In this manner a correct ratio between the air quantity and the fuel quantity can only be obtained if the pressure drop at the air controlling member and that at the fuel controlling member remain constant in all positions of said members. In the well known devices of this type this condition is not existent due to the fact that the influx of the combustion air into the combustion chamber of the engine fluctuates with the number of revolutions, wherefore the coupling of the air controlling element and the fuel controlling element referred to is inadequate.

In order to eliminate this drawback, the present invention aims at providing pressure sensitive means responsive to the pressure in the air intake conduit in front of the air controlling element for automatically controlling the pressure drop determining the inflowing air quantity in the intake conduit regardless of any pressure fluctuation resulting from the pressure variation in the engine's combustion chamber.

There are two possibilities for realizing this inventive principle:

(1) The pressure sensitive means referred to may be used for maintaining a constant pressure drop at the air controlling element so that the air quantity is merely dependent on the cross section adjusted by the air controlling element. In other words, the air quantity supplied is always proportional to the position of said element.

(2) Instead of maintaining constant the pressure drop and varying the cross section for controlling the air quantity, it is also possible to maintain the cross section constant and to control the air quantity by varying the pressure drop. In the latter event the pressure sensitive means will be combined with means for varying the so-called adjustment value, i. e. the value of the absolute pressure to be maintained constant by the air element.

Referring now to the drawings, Fig. 1 shows an embodiment based on the first mentioned principle. The air intake conduit **1** leading to the engine (not shown) is provided with a butterfly valve **2** rotatably mounted about a fixed axle **3**. Fastened to the valve **3** is a cam **4** engaging one end of a lever **5**, the other end of which engages a fuel control needle **6** having a spring **7** which holds in engaging relation the lever **5** and the needle **6** as well as the cam **4**. The lever **5** has an axle **8** supported in any convenient manner by the conduit **1**.

A rod **9** linked with the cam **4** may be manually operated for adjusting the valve **2** and the fuel needle **6** in response to the engine load. If for instance the rod **9** is moved in the direction of the arrow x, the valve **2** will be further opened and at the same time the lever **5** moves in a clockwise direction so that the spring **7** further lifts the needle **6**, thereby increasing the fuel cross section.

It may be pointed out that the controlling curve **4**a of the cam **4** may be formed in accordance with any desired variation of the fuel-air ratio upon the simultaneous adjustment of the

valve 2 and the needle 6. It may, for instance, be desirable to enrich the fuel-air mixture as a function of the cross section controlled by the valve 2.

The fuel enters a float chamber 10 of the well known type comprising a float for maintaining a constant level in said chamber. A channel 11 leads from said chamber to the needle 6 and communicates with the conduit 12 which in turn communicates with the conduit 1 so that the fuel controlled by the needle 6 enters into the combustion air flowing through the intake conduit 1.

According to the invention, beside the butterfly valve 2 a second throttling member 13 is provided in the conduit 1 behind the valve 2. The second member 13 will be automatically controlled in such manner that the pressure drop at the main valve 2 (to be manually adjusted) remains constant in all positions of said valve. To this end a pressure sensitive means is provided—shown to be a diaphragm 14—arranged in a casing 15 the left hand chamber 16 of which communicates with the conduit 1 and comprises a compression spring 17 exerting a force on said diaphragm. The right hand chamber 18 of the casing 15 is in communication with the outer air via an orifice 19, so that the pressure in 18 is equal to the atmospheric pressure.

The device described operates as follows: Be it assumed that the suction behind the member 13 increases due to an increase in the number of revolutions. Such a change of suction will likewise result in a suction increase in front of the member 13, i. e. behind the main valve 2, whereby the pressure drop at 2 will be increased. Any pressure variation in front of 13 acts upon the diaphragm 14. In case of a suction increase, the pressure variation exerts a force on the diaphragm in the direction toward the conduit 1, so that an anti-clockwise rotation is imparted to the member 13. Therefore the cross section controlled thereby will be decreased and accordingly the suction between 13 and 2 will again be decreased until the predetermined pressure drop to be mainatined at 2 is restored.

As will be readily understood from the foregoing, the member 13 does not only control the pressure drop at the main valve 2, but likewise that at the fuel needle 6, since the conduit 12 is connected to the part of the intake conduit 1 in which the pressure is maintained constant by means of the member 13.

Obviously the member 13 upon an anti-clockwise movement may influence the pressure drop at the main valve 2 until it reaches its terminal open position. As soon as this position is reached, the cross section controlled by the member 13 cannot be further increased. Therefore it is possible that in the completely open position of the member 13 the pressure drop at the main valve 2 does not remain constant. In order to overcome this difficulty, additional means are provided for closing the fuel needle 6 and the main valve 2 as soon as the member 13 approaches its terminal open position. In the embodiment according to Fig. 1 this auxiliary means comprises a stud 20 fixed to the diaphragm 14 in the chamber 18, said stud being adapted to engage upon a nearly full right hand stroke of the diaphragm 14 a lever 21, the lower end of which is by means of a spring forced against a stop 23. The lever 21 is linked to the rod 9 and connected to any suitable controlling rod 24 to be manually operated by the gas lever 26. Upon adjustment of the gas lever 26 the lever 21 rocks about the stop 23 as a pivot point. As soon as the member 13 approaches its terminal open position, the stud 20 shifts the lever 21 away from the stop 23, thereby rocking it about the point 25 in an anti-clockwise direction so that the main valve 2 and the fuel needle 6 are closed.

Fig. 2 represents another embodiment based on the principle according to which the cross section of the intake air flow remains always constant, whilst the air quantity is controlled by varying the pressure drop determining the intake air flow.

The various parts of this embodiment also mentioned above in connection with Fig. 1 have the same reference numerals and therefore need not be enumerated in distinction from Fig. 1. The main air valve 2 is dispensed with so that the air inflow is only controlled by means of the throttle member 13 operatively connected to the diaphragm 14 in the same manner as described with reference to Fig. 1. Whilst the main valve 2 was provided for varying the air inflow by varying its cross section, the embodiment according to Fig. 2 leaves the cross section of the intake opening of the conduit 1 unchanged. The pressure drop of the air intake through said unchanged cross section will be determined by the position of the throttling member 13. Instead of the compression spring 17 in the chamber 16 (Fig. 1), a tension spring 27 is arranged in the chamber 18 as shown in Fig. 2. The tension force of this spring corresponds to the counterforce exerted by the suction in the chamber 16. As long as the tension force of said spring 27 remains unchanged, the position of the throttling member 13 likewise remains unchanged so that the pressure in front of the member 13 and the pressure drop at the intake opening of the conduit 1 remain constant. As may be readily understood, by any change in the tension force of said spring 27 a corresponding variation of said pressure drop and of the air quantity flowing in will be obtained. Accordingly means are provided for varying the initial tension of the spring 27 in response to the air quantity to be supplied. In the same manner as shown in Fig. 1 these means are controlled by the gas lever 26. The rod 24 operatively connected to the gas lever is linked to the lever 21 as at 25. The lever 21 is connected to a cam 28 by means of a link 29, said cam being rotatably mounted at 30 and engaged by a roller 31 provided at the end of a lever 32. This lever is swingably mounted at 33 and engages with its fork-shaped lower end a sleeve 34 slidably mounted in a housing 35 fastened to the diaphragm casing 15. The tension spring 27 being fastened to the bottom 34′ of said sleeve 34, any displacement of the sleeve due to a controlling movement of the gas lever results in a corresponding change of the initial tension of the spring and accordingly in a corresponding change in the pressure drop as well as in the air quantity flowing in.

The lever 21, in a manner similar to that shown in Fig. 1, is held in contact with a stop 23 by means of a spring 22′ (corresponding to the spring 22 of Fig. 1).

If now for instance the gas lever is depressed, the lever 21 and the cam 28 rock in a clockwise direction so that the lever 32 rocks in an anti-clockwise direction and displaces the sleeve 34 to the right. As a result the initial tension of the spring 27 is increased and the throttling member 13 is further opened until the suction in the conduit 1 and in the diaphragm chamber 16 reach the greater value necessary to restore the

equilibrium. An increased suction in the conduit 1 results in an increased amount flowing in.

At the same time the fuel quantity controlled by the needle 6 will be correspondingly increased as shown in Fig. 2, the clockwise movement of the lever 21 is varied by a movement of a bell crank lever 36 in like direction so that the spring 7 as described in connection with Fig. 1 raises the needle 6.

With reference to the auxiliary means (stud 20) for additionally influencing the controlling operation, the embodiment according to Fig. 2 likewise corresponds to that of Fig. 1. As may be seen from Fig. 2, the diaphragm 14 is again provided with a stud 20′ into the path of which projects the lower end of the lever 21, so that, as described above, this lever will be rocked in an anti-clockwise direction about the stud 23 as pivot point as soon as the stud 20′ contacts with the lever 21 immediately before the controlling member 13 reaches its terminal open position.

The cam 28 provided for varying the initial tension of the spring 27 may also be used to serve the same purpose as the cam 4 in the arrangement according to Fig. 1. The form of the controlling curve of the cam 28 should therefore be in accordance with the variations of the fuel-air ratio as described in detail with reference to Fig. 1.

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G. WÜNSCH

CONTROLLING OR REGULATING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 26, 1940

Serial No. 315,835

2 Sheets-Sheet 1

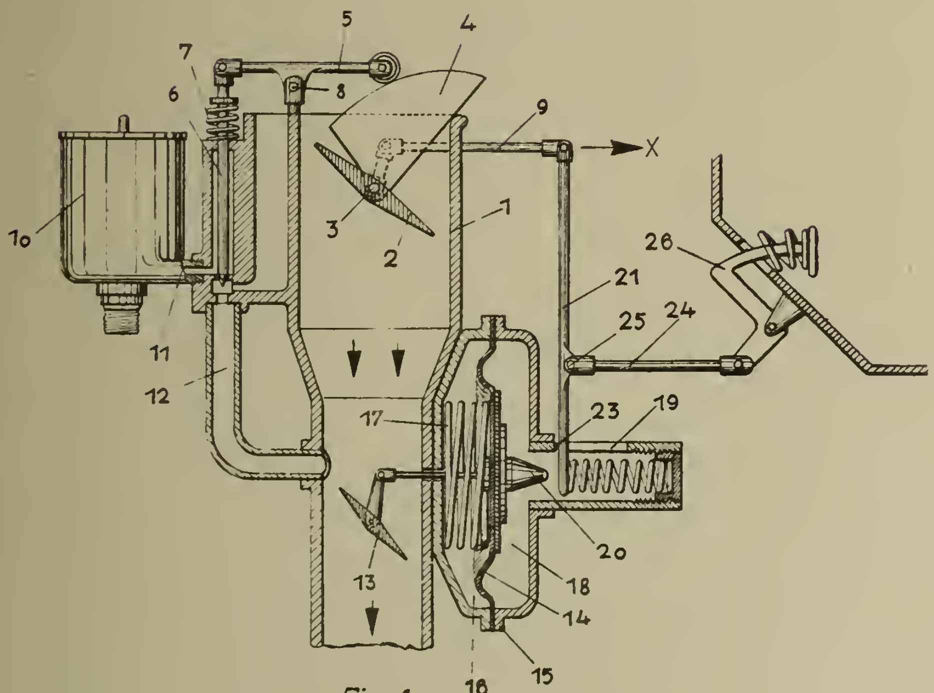

Fig. 1

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2 Sheets-Sheet 2

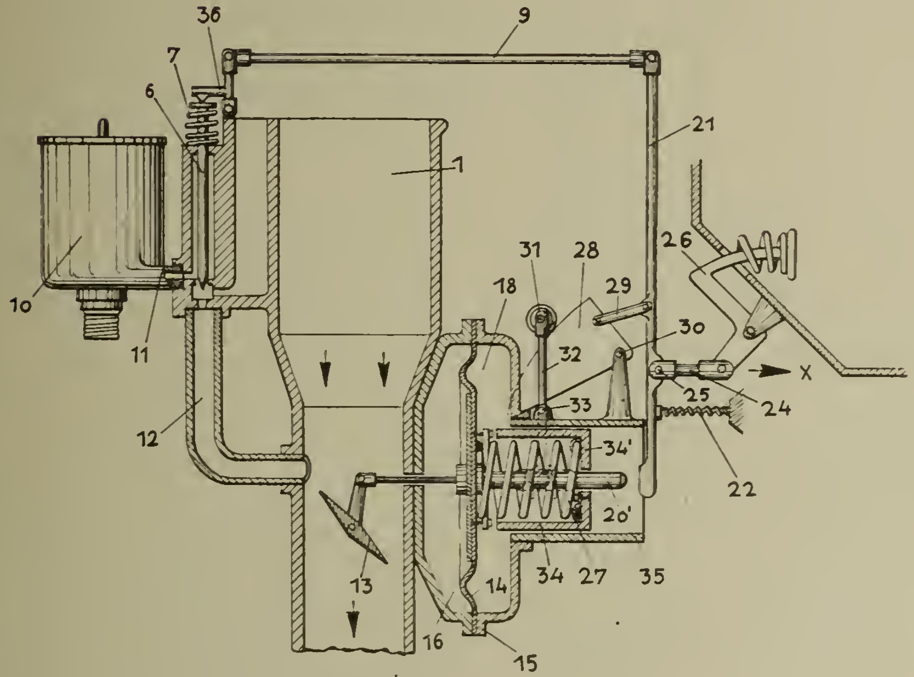

Fig. 2

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ALIEN PROPERTY CUSTODIAN

PREPARATION CONTAINING B-VITAMINS AND PROCESS FOR THE MANUFACTURE OF SAME

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No Drawing. Application filed February 20, 1940

This invention relates to preparations containing B-vitamins and has for its object a solid preparation rich in B-vitamins as well as a method for the manufacture of same.

An important feature of the solid vitamin preparation according to the present invention consists therein that it contains the B-vitamins intimately intermixed with a solid substance having the property of acting as an adsorption agent for B-vitamins and being at the same time of such a character as to exert no injurious action on the human organism.

An important feature of the method of manufacturing the vitamin-preparation according to the invention consists in the combination of the steps of adding an adsorption agent to a liquid containing the B-vitamins to bring about adsorption of the vitamins on the added adsorption agent, separating the liquid from the solid mixture of adsorption agent and adsorbed vitamins and removing sufficient liquid from the solid mixture to obtain an apparently dry substance in the form of a powder, granules, tablets or the like.

The use of adsorption agents (such as kieselguhr, Fullers earth or other infusorial earths, active carbon and the like) to separate B-vitamins from yeast extracts and other liquids containing the said vitamins is well known, but in the hitherto known methods this adsorption step has always been followed by an eluation or lixiviation operation to separate the adsorbed matter from the adsorption agent, the solution being further treated separate from the adsorption agent to obtain the desired vitamin B concentrate.

In the process according to the present invention such eluation or lixiviation is not resorted to, the adsorption agent with the adsorbed vitamins being directly converted into a commercial solid vitamin preparation, in which the adsorption agent enters as a necessary constituent.

By this method of proceeding several important advantages are attained. The entire procedure required to obtain vitamin preparations ready for sale is greatly simplified. The output of vitamins is great, because the losses involved by the lixiviation and subsequent operations are avoided. And it is by the present process possible by simple and inexpensive means to obtain preparations containing the entire vitamin-B-complex.

The solution of B-vitamins which is to be subjected to the treatment with adsorption agent may be produced from yeast by known methods, for example by extracting the yeast (which may be ordinary beer yeast or a baker's yeast) with water or aqueous solutions. The adsorption agent may be some active earth, such as Frankonite or Fullers earth, active carbon or the like.

After the adsorption operation, the liquid may be separated from the adsorption agent with adsorbed matter by centrifugal treatment, filtration or other suitable treatment. The mass may thereupon be subjected to further dehydration by evaporation at low temperatures and may thereafter be shaped into granules, tablets or like bodies of suitable shape and size, with or without foreign additions. The final dehydration of the product may also, when desirable, be effected subsequent to the shaping operation. The product may also be marketed in the form of a more or less fine powder. The shaping of the product may be carried out in the conventional manner and by the aid of suitable binding agents, such as sugar or gelatine. The dried product into which such binding agent has been incorporated, may be shaped into tablets, containing a desired definite amount of vitamins.

The treatment of the initial solution with adsorption agent may be carried out in one or more stages. If the treatment is carried out in two or more stages, the resulting fractions of adsorption agent with adsorbed matter may be mixed, dried and further treated as a mixture. Or each fraction may be treated separately to obtain commercial preparations of different character. The solutions to be treated with adsorption agent may also be obtained from the original raw material (for instance beer yeast) in one, two or more stages under equal or differing conditions.

Example I

5 kg, of beer yeast are introduced into 5 liters of water, to which has been added hydrochloric acid in a quantity sufficient to produce a degree of acidity corresponding to a pH value of 4–5. The mixture is boiled up or heated to ca. 90° C. for about one quarter of an hour, whereupon the liquid is subjected to centrifugal treatment. To the clear liquid Frankonite K. L. in a quantity of 100 gr. is added, and the suspension is stirred for about one hour. The adsorption agent (Frankonite) with adsorbed matter is then separated from the liquid by centrifugal treatment and thereupon dehydrated at 60–70° C. The mass containing the vitamin-B-complex intimately incorporated into the Frankonite is shaped into tablets in the conventional way by the aid of agglutinants and so as to obtain tablets containing a predetermined amount of the B-vitamin-complex.

Example II

500 kg. of ordinary press yeast are suspended in 100 liters of water and the suspension is heated as rapidly as possible to about 90° C. Hydrochloric or sulphuric acid is added in a quantity to produce a pH of 4–5. The yeast cell skins are separated from the solution by centrifugal treatment.

The cell skin residum is mixed with a further quantity of water and the mixture heated to 90° C. So much hydrochloric or sulphuric acid is added that the liquid is adjusted at a pH of about 1. The liquid is then subjected to a centrifugal treatment to remove the cell skin residuum.

The extract first obtained having a pH of about 4–5 is stirred with 2–4 kg. of kieselguhr for 2–3 hours. The kieselguhr with adsorbed matter is thereupon separated from the liquid by centrifugal treatment and then dried under vacuum.

The second extract is also stirred with 2–3 kg. of kieselguhr for about 2–4 hours. The solids are thereupon separated from the liquid and dried.

The two fractions of kieselguhr with adsorbed vitamins may be treated separately to obtain different grades of vitamin-B-preparations, or they may be mixed together to obtain the whole complex in the same preparation.

It has been found that by operating in stages as described in this example it is possible to attain a more complete recovery of all of the vitamin B factors in the raw material.

By additional treatment or treatments with adsorption agents in a liquid having a pH different from that of the first stage treatment, the remainder of the vitamin B factors in the raw material will become absorbed. By mixing the various fractions preparations can be obtained which contain the entire vitamin B complex.

In stead of treating each of the original extracts separately with adsorption agents, the extracts may be mixed and thereupon treated with adsorption agent in two or more stages at different pH values as described.

ALF OLSEN.

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ALIEN PROPERTY CUSTODIAN

CONTROL LIMITATING DEVICES ON AIRCRAFT

Roger Léger Marie Fernand Rouanet and François Victor André Joseph Rey, Paris, France; vested in the Alien Property Custodian

Application filed February 21, 1940

It is a known fact that it is of interest to limit the abruptness of the evolutions of aeroplanes and other aircrafts, and particularly the longitudinal evolutions. In fact the greatest stresses which are to be supported by the cells are those which are due to a sudden "resource" i. e. a considerable and rapid increase of the incidence of the wings, when flying at high speeds. A "resource" which is too strongly marked, which is brought about by a too abrupt and a too extensive operation of the elevator by the pilot may, in certain cases, cause the breakage of the machine.

Moreover, a sudden change in the incidence of the wings may also result artificially from the action of gusts of wind exerted upon the wings; this action may have the same harmful consequences as a "resource" and may in some cases, cause the breakage of the machine by the effect of the resultant heavy overloads.

The present invention has for its object to provide a device which serves to limit these various overloads by an automatic action upon the elevator or elevators, which device is adapted for use upon aircraft in which each wing is pivoted about an axis (which is oblique or not with reference to the longitudinal axis of the machine) and is maintained in equilibrium by suitable elastic connections.

In such machines with pivoted wings, the position of each wing relatively to the frame carrying the pivot axle will obviously depend upon the aerodynamic loads supported by this wing and upon the elastic connections mounted between the wing and the frame. A change in these loads will cause the wing to rotate about its pivot axis, in the direction corresponding to this change (an upward rotation in the case of an overload in the upward direction which is due, for instance, to a sudden increase of the incidence in one of the cases above mentioned).

The device forming the subject-matter of the invention is based upon this property. It is characterized by the fact that it consists of a connection (mechanical, hydraulic, pneumatic, electric or the like) between each wing and the control surfaces for elevation and/or for lateral inclination, or their controlling mechanism, which connection is designed in such manner that when the loads supported by any one of the wings shall exceed a given value (which causes a rotation of a given amplitude of this wing about its pivot axis) the said connection will automatically cause a correcting action upon the control surfaces or their operating mechanism.

For example, if one of the wings should receive a heavy load in the upward direction, the resulting movement of rotation of this wing in the upward direction about its pivot axis will automatically produce, by reason of the said connection, an action upon the control surfaces or upon their controlling mechanism, in the direction creating a noseheavy moment upon the areoplane; this action will actually reduce or limit the incidence of the wings and hence the above mentioned overload.

The same system can of course be used in the case of excessive overloads in the downward direction.

In the accompanying drawings, which are given merely by way of example:

Fig. 1 illustrates a mechanical connecting device according to the invention, in the case in which it is desired only to automatically limit the overloads acting upwardly on the wings.

Fig. 2 shows another embodiment, providing for a limitation of the loads in both directions.

In the embodiment shown in Fig. 1, the aircraft comprises two wings 1, each of which is pivotally mounted on the central body of the aeroplane on an axle 2. Each wing 1 is provided with an appendage 3 to which is attached the end of an elastic connecting member 4 whose other end may be secured directly to the central body of the machine or (as in the embodiment illustrated) to one end of a rocking lever 5 adapted to turn about an axle 6 carried by the central body of the machine.

When one of the wings 1 turns upwardly about the axle 2, its appendage 3 descends, and if the rotation attains a certain extent, the end of this appendage will engage one arm 7 of a bell-crank lever 7, 8 which is loose upon a transverse axle 9. The upward rotation of the arm 7 is limited by a stop 8^a whose position can be fixed or adjustable.

The second arm 8 of each bell-crank lever 7, 8 is connected by a link 10 to a crank-arm 11 which is keyed to a sleeve 12 adapted to rotate about a transverse axle 13. The said sleeve has rigidly secured to it an arm 17 ending in a plate 18. A spring 19, attached to a fixed point 19^a, tends to rotate the arm 17 and the sleeve 12 in the contrary direction to the arrow f^1, and hence to turn the bell-crank lever 7, 8 in the direction applying the arm 7 against the stop 8^a.

In the present embodiment (which corresponds, as above stated to the case of upwardly

directed overloads) the plate 18 is situated in the rear of the elevator actuating means; this being illustrated as a control stick 20 which is connected by a link 21 with the elevators, not shown, which are thus actuated by the rotation of the control stick 20 about the transverse axle 22. The movement of the elevator or elevators in the direction of the "resource" corresponds to a force exerted upon the control stick 20 in the direction of the arrow f^2.

As the said control stick can also turn upon a longitudinal axis 23 (this rotation being used to actuate the control surfaces for the lateral inclination of the machine), the plate 18 has a sufficient length to enable it to remain on the path of the control stick when this latter turns on the transverse axle 22, whatever be the possible rotation of the stick on the longitudinal axis 23.

If the control lever is of the steering wheel type, the lever serves only to actuate the elevator, i. e., it turns only on a transverse axle 22 which is fixed relative to the machine. The length of the plate 18 may thus be suitably reduced.

It should be noted that in the embodiment illustrated, the longitudinal axle 23 of rotation of the control stick extends below the sleeve 12 without engaging the latter.

From the foregoing, it is clear that if one of the wings 1, (or both wings 1, if they have the same inclination about their respective axis 2) pivots upwardly about its axis 2 to a sufficient degree to bring its appendage 3 into engagement with the arm 7, it will cause this arm to pivot downwardly, and this will cause (owing to the connection 8, 10, 11, 12) the rotation of the sleeve 12 and the plate 18 in the direction of the arrow f^1. This rotation of the plate has the effect of limiting the movement of the control stick to the rear, and hence the possible upward overloads on the wings. This limit cannot be exceeded by the pilot, as he cannot overcome the resistance offered by the said plate which is maintained by the wing or wings 1.

Fig. 2 which is given merely by way of example and is not of a limitative nature, illustrates a mechanical connecting device according to the invention, in the case in which it is desired to limit automatically, on the one hand, the excessive overloads in the upward direction and on the other hand the excessive overloads in the downward direction.

This figure does not show the pivoted wings, the elastic connections nor the rocking-arm which are supposed to be the same as in Fig. 1.

Above and below the end of the appendage 3 of each wing, are mounted two arms 7 and 7ª which are rotatable respectively on parallel transverse axles 9 and 9ª, and are constantly urged into their mean position, for example by two biasing springs 25, 26 or by a single spring having a dead center.

The arrangement of the arms 7 and 7ª with reference to the appendage 3 of the corresponding wing is such that they are not actuated by the movement of the wings about their respective axes, except when this movement attains a predetermined extent, which corresponds, as above stated to a predetermined limitation of the overloads on the wings in the upward or downward direction.

The arms 7 and 7ª are connected together by a link 27 and each arm 7 is integral with an arm 8 whose end is connected by a link 10 with the crank-arm 11, keyed to the sleeve 12 which is rotatable on the transverse axle 13. To the sleeve 12 is rigidly secured an arm 17 terminated by a ring 18ª, through which the control lever 22 passes. In the case in which this lever is of the control stick type (which is the case for Fig. 2) the ring 18ª is formed in such a manner as to allow a lateral movement of the control stick about the axle 23 which is sufficient to provide for the lateral control of the machine. In the case in which the control lever is of the steering wheel type, it only serves to operate the elevator. In this case, the transverse axle 22 about which it is rotatable is fixed with reference to the machine and the transverse dimension of the ring 18ª can be suitably reduced. The ring 18ª can obviously be replaced by any other piece having a different form, whether closed or open (such as a fork) which will afford the same results.

It will be noted that the two wings, if they have the same inclination about their axes of oscillation 2, or the wing which is the farther from the mean position, will determine, starting from positions corresponding to the limits of the admissible loads in the upward or downward direction, the position of the ring 18ª, by the connection 3, 7, 10, 11, 12, 17, 18ª, or by the connection 3, 7ª, 10, 11, 12, 17, 18ª. Hence they will determine the limits for the movement of the elevator actuating lever 20 which are compatible with the conditions of safety of the machine.

Obviously, the invention is not limited to the embodiments herein described and shown, which are given solely by way of example.

The action exerted upon the plate or the ring may be such that it can be overcome by the pilot, and thus it will serve only as a warning to this latter.

Instead of acting upon the elevator actuating lever, it is possible to act at any point of the control surface actuating mechanism, or upon the control surface itself.

These direct actions can be completed by warning devices.

It is further possible to use the same device in order to exert a correcting action connected with the rotation of the wings about their respective pivot axes, upon the control surface or surfaces for the lateral inclination of the machine (or upon the operating mechanism of said controls). This action which can of course be overcome by the pilot, will induce him to make a correct turn, and it may be further used to assure the lateral stability of the machine.

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CONTROL LIMITATING DEVICES ON AIRCRAFT

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Fig.1

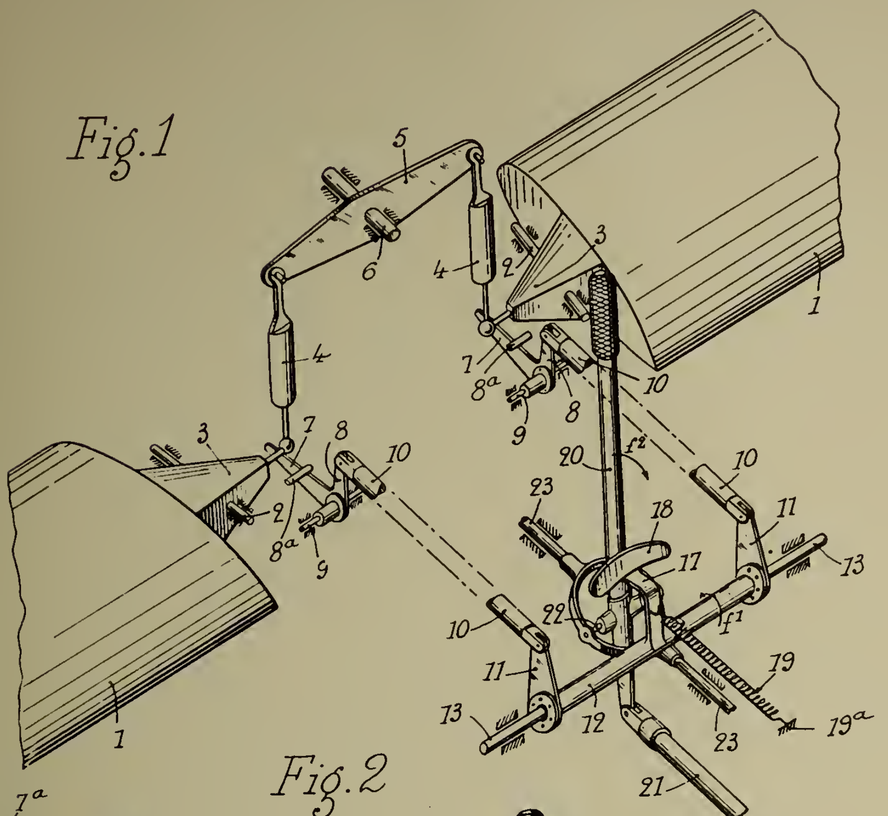
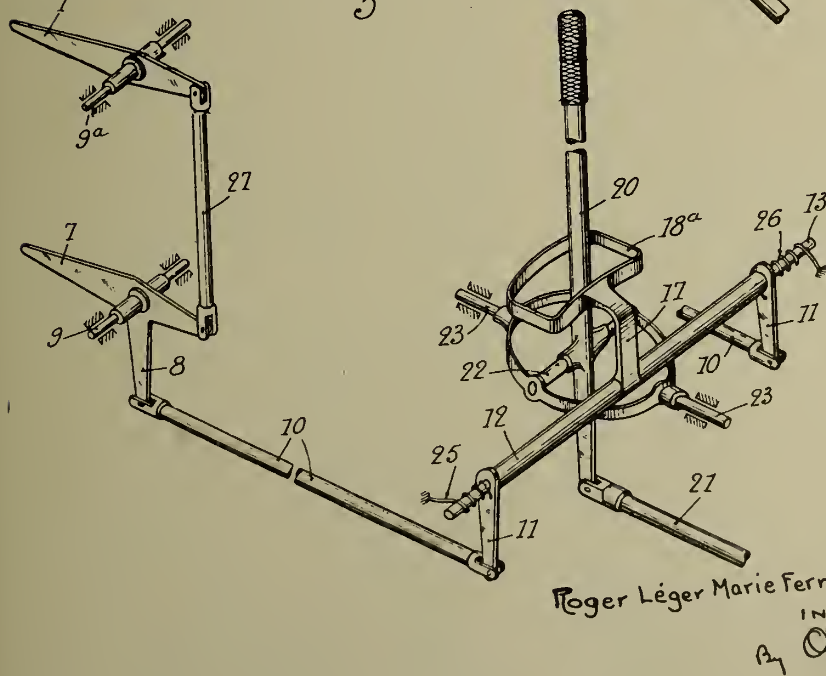


Fig.2



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his ATTY.

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ALIEN PROPERTY CUSTODIAN

MAGNESIUM BASE ALLOYS

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No Drawing. Application filed March 2, 1940

This invention relates to magnesium base alloys.

The high percentage magnesium base cast alloys heretofore known, generally contain as alloying constituents substantially only aluminium and zinc, the aluminium content amounting to between about 4 and 10% and the zinc content up to about 3%, the zinc content being smaller as the aluminium content is increased. Depending on the particular composition of the alloy and on the type of casting process (sand, chill mould or pressure die casting), these known magnesium base cast alloys have in the "as cast" state, a tensile strength of from 16 to 22 kgs. per square mm., an elongation of from 3 to 12% and a yield point of from 8 to 16 kgs. per square mm. (see "Werkstoffhandbuch Nichteisenmetaile," 1936, Sheet K. 3).

However these known alloys have the disadvantage that they suffer from a tendency to micro-shrinkage on solidification. This micro-shrinkage leads to the formation of microscopic discontinuities in the structure which not only involve a certain lack of tightness of the casting against pressure of liquid or gaseous media, but which also have a notch effect and thus, on occasion, substantially impair the strength properties attainable in the case of a sound structure, particularly in highly stressed thick sections. Attempts have hitherto been made to counteract micro-shrinkage by an ample use of chill plates and other measures for the rapid cooling of such sections; such measures, however, are expensive to apply and their effect is difficult to control in practice, moreover they are frequently only partially successful.

The present invention aims at providing new magnesium base alloys which are equal and in some cases even superior to the hitherto known magnesium base cast alloys in respect of mechanical strength, whilst being much less liable to micro-shrinkage than such known alloys.

The alloys of the present invention are characterised in that they contain cerium in amounts ranging between about 0.1 and about 2% as well as zinc between about 0.5 and about 12%. Preferably, the cerium content varies between about 0.5 and about 1.5%, while the zinc content is maintained between about 4 and about 8%.

The term "cerium" used herein is intended to include the so-called "Cerium Mischmetall."

In addition to the aforementioned metals, the alloys of the present invention may contain further alloying constituents which are soluble in magnesium in the solid state in the presence of the specified amounts of the two principal alloying constituents viz. cerium and zinc. Such additional alloying constituents are especially cadmium, tin and silver. The amount of these additional alloying constituents can be up to 10%, but preferably does not exceed 4%. The alloys of the present invention may also contain aluminium but in this connection it has been found that the presence of substantial amounts of aluminium, i. e. about 1% or more, introduces an increased tendency to micro-shrinkage which becomes exceedingly pronounced when the aluminium content exceeds 3%. Consequently the alloys of the present invention are preferably free from aluminium or if they contain aluminium as an intentional constituent, the aluminium content is preferably less than 1%.

The presence of even the smallest amounts of silicon likewise has an unfavourable effect on the properties of the alloys of the present invention, so that the silicon content of the alloys should be kept below 0.05% and preferably below 0.01%. The presence of antimony is also detrimental. On the other hand, the normal iron content of magnesium (about 0.05%), which in the case of hitherto known magnesium cast alloys was regarded as undesirably high, not only has no unfavourable effect in the case of the alloys of the present invention, but even appears to improve the properties of said alloys.

For the purpose of improving their resistance to corrosion, the alloys of the invention preferably also contain between about 0.3 and 0.8% of manganese.

It has further been found that the mechanical strength properties of the hereindescribed alloys can be very considerably further improved by suitable heat treatment. This heat treatment comprises heating (soaking) the alloys for several hours, preferably at the highest possible temperatures, i. e. as closely as possible below the solidus point, and, after rapid cooling (for example in the atmosphere), annealing them for a longer period than the soaking period, at lower temperatures (between about 120 and 250° C.). For an alloy containing 0.75% of cerium and 4% of zinc, for example, heating at 515° C. for 5 hours and annealing at 175° C. for 20 hours or longer have been found convenient. The soaking can also be dispensed with on occasion and the heat treatment restricted to the annealing, in which case, however, the aforedescribed improvement of the mechanical properties is generally substantially smaller.

In the following table a number of alloys according to the invention are given by way of example, together with their mechanical strength properties. By way of comparison the corresponding values of two magnesium base alloys (No. 1 and No. 2 in the table) are indicated, the first of which contains 0.3% of manganese as sole alloying, constituent and the second 0.3% of manganese and 0.5% of zinc, as the sole, alloy-

ing constituents, both alloys thus being free from cerium.

No.	Alloy				State	Strength properties		
	Ce	Zn	Cd	Mn		Tensile strength	Elongation	Yield point
						Kgs. per square mm.		*Kgs. per square mm.*
1	----	----	----	0.3	Chill casting.	14.4	7.4	3.9
2	----	0.5	----	0.3	do	10.5	4.7	3.3
3	0.25	0.5	---	0.3	Chill casting.	19.0	20.0	6.0
4	0.75	2.0	----	0.3	do	20.4	17.6	8.1
5	0.75	4.0	----	0.3	do	21.2	13.7	8.3
6	0.75	6.0	----	0.3	do	20.1	8.0	8.7
7	1.0	2.0	----	0.3	do	19.3	12.9	7.9
8	1.0	6.0	---	0.3	do	22.3	11.0	8.9
9	1.5	2.0	----	0.5	do	17.6	7.0	7.5
10	1.5	6.0	----	0.5	do	18.2	7.2	7.1
11	1.0	2.0	----	0.5	Sand casting heat treated.	22.5	10.4	13.5
12	0.75	5.0	----	0.5	do	25.5	5.0	18.3
13	0.75	6.0	----	0.5	do	28.5	3.4	22.3
14	0.75	4.0	4.0	0.5	Sand casting heat treated.	26.3	9.4	16.8

The best strength properties are usually obtained with smaller contents of cerium; an increase in the cerium content within the limits defined by the invention, however, leads to a still more complete suppression of micro-shrinkage. By suitably proportioning the content of the alloys of the present invention it is thus possible to produce alloys having particularly good strength properties or else alloys particularly free from a tendency to micro-shrinkage, the choice between the two alternatives depending substantially on the purpose for which the alloys are intended.

The alloys of the present invention are not only suitable for the production of shaped castings, but also possess good properties in the wrought state.

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ALIEN PROPERTY CUSTODIAN

DEVICES FOR REGULATING RADIO SETS AND THE LIKE

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My invention relates particularly to a method of regulating radio receiving sets and the like by means of inductance variations in iron cores.

As is well-known, with sufficiently fine subdivision of suitable types of iron alloys, it is possible to provide high-frequency coils with magnetic cores. If the cores are made displaceable within the coils tuning can be effected by such displacement in a manner well-known per se. This variation of inductance, however, can also be obtained in a different manner, e. g. by varying the preliminary magnetisation of the core by means of a direct current. Such a method of varying the inductance offers a large number of possibilities of utilization, one very interesting instance of which comprises the provision of an automatic volume control.

In the simplest case, such an apparatus works as follows: An oscillatory circuit, tuned in some manner to the wave to be received is provided, the oscillations of which are applied to an audion. In the oscillatory circuit, a part or the whole of the inductance is arranged on a coil of ferromagnetic-material e. g. Ferrocart. In the anode circuit of the audion, there is provided a simple filtering means, which separates the direct current component of the anode current from the alternating current component. The alternating current component (modulation frequency) is supplied to the consumer, that is, a telephone or a further amplifier, and the direct current component is led through a second winding on the ferromagnetic core of the tuning coil.

On increase of the audion current or decrease of the audion current (according as to whether grid or anode current rectification is employed), the result can then be obtained that, if normal volume is employed, the coil is just tuned to the oscillation to be received. If the volume increases beyond an agreeable extent, then (assuming that working is being effected with the detector tube at the lower bend) an increase of the anode current causes a decrease in the inductance of the coil, which de-tunes the receiving oscillatory circuit to such an extent that an agreeable volume is just restored. It is seen that a simple volume control device can be assembled in this manner. In this case it is possible, not only to decrease the volume if the reception is too powerful, but also, quite simply if the volume is insufficient, in which case the disturbance level would be too high in proportion, to obtain a decrease of volume. For this purpose, it is only necessary to balance the tuning accurately at a mean value of the volume. If the volume falls below this value, then by weakening the direct current component of the anode current of the detector tube, an increase of the inductance and this de-tuning will occur, while with excessive volume or field strength of the receiver oscillation at the receiving station, the self-inductance becomes too small. In normal automatic volume control arrangements there often exists an undesirable relationship between the time constant of the regulating circuit and the regulating quality or other characteristics of the regulator. With the present construction and also in all other possibilities discussed here, however, it is possible regardless of the time constant, to suppress any other action between the regulating and regulated circuit by entirely decoupling the regulating circuit from the regulated circuit, e. g. by use well-known per se of a three-limb transformer or the like. If due to small asymmetries in the masses of the limbs or in the coil configuration, there should be no complete decoupling at the outset, then a subsequent correction can be obtained either by displacement of individual convolutions or groups of convolutions or by readjusting the core by a slight subsequent deformation, say, by cutting off small particles or by deformation by pressure, which is quite possible in view of the relatively soft consistency of such cores.

Should the presence of a sharp resonance curve cause an excessive instability in the volume, any desired flattening of the regulating curve may be produced by increasing the damping of the circuit. It is also possible by the use of chain conductors to deform the resonance curve in such a manner that the desired regulating characteristic is provided. In order that the selectivity of the reception may not be impaired by such measures, individual invariable, more or less sharply tuned, circuits may be employed for the actual receiving selection and these circuits coupled to the detector tube by circuit variable in its tuning in accordance with the volume in the manner hereinbefore described. Of course, any desired number of high-frequency amplifying stages may also be connected in series with the detector tube, which stages may be influenced by the receiving field strength in a similar manner as has been herein described for a detector. The greater number of stages in which the influencing is effected, the greater of course is the effect. In order to avoid, particularly in the case of a number of circuits, displacing the resonance position of the whole receiving system within the frequency spectrum in accordance with the volume, it may be preferable in two successive circuits or else within a single circuit by reversal of the direction of current in the preliminary magnetisation windings on occurrence of the regulating action, to displace the resonance position of the part-circuits of a system in the opposite direction in the frequency spectrum, so that the resultant resonance position remains unchanged. Since the regulating circuit is decoupled in relation to the regulated circuits, the same regulating current in series-connection or parallel-con-

nection may traverse the regulating windings of the transformers of a larger number of series-connected amplifier stages without any tendency of the successive amplifier stages to oscillate, arising. To this end, exact decoupling is alone essential, and this can be ensured by any means well-known per se. In order also to prevent capacitive back-couplings through the regulating line, it is preferable to provide for good direct earthing or earthing effected through adequate capacities. However, as is hereinafter shown, volume control is not only obtainable by means of de-tuning. A very simple alternative for instance, comprises automatically regulating the back-coupling, the back-coupling being effected through one of the aforementioned ferromagnetic mass cores or the like.

Other regulating actions can also be obtained in accordance with the invention: Thus, for instance, it is well-known that with only weak reproduction an apparent displacement of the deep sounds occurs. Since, variation of the preliminary magnetisation causes variation of the inductance it is possible with low-frequency transformers or low-frequency sound monitoring arrangements, by means of filters etc. to ensure that the constants of these constructional elements automatically vary in such a manner that the percentage of deep sounds is increased or reduced as desired in relation to the percentage of high sounds, so that with changes of volume, effected for instance, by a manual regulator, provided, in addition to the automatic regulator, the inductance of the low-frequency transformers of the low-frequency chokes or any kinds of smoothing members are so varied that in addition to the automatic or non-automatic volume control, a variation of the timbre automatically occurs in accordance with a pre-determined law. The means for this purpose are no doubt known. If it is desired to obtain an increase in the precentage of deep sounds, then, for instance, in low-frequency transformers, the result will be obtained that due to the reduction of the general volume and due to the preliminary magnetisation reduced thereby, in a corresponding winding, the inductance of the transformer increases whereby, as is well-known, the transmission of deep sounds is also favoured and vice-versa. If an increase in the anode direct current, or other current component employed for preliminary magnetisation, is to produce an increase instead of a decrease in the inductance, then this can be done simply by providing a constant preliminary magnetisation by means of a constant direct current or permanent magnet in addition to the variable magnetisation, in such a manner that the variable and fixed preliminary magnetisations act in opposition to one other. As the variable magnetisation diminishes, the fixed predetermined preliminary magnetisation is then no longer counterbalanced and hence comes into action.

In addition to the methods of automatic volume control and automatic tone control already discussed, it is possible according to the invention to effect tuning of an apparatus quite advantageously, not for the purpose of volume variation, but for the purpose of adjustment to different transmitters. Since it is possible to tune oscillatory circuits merely by varying the direct current intensity of the preliminary magnetisation, this provides, for instance, a method of adjusting a receiver which may be carried out with a very small number of mechanical parts. Since a tuning coil having a Ferrocart or a similar core, and a blocking condenser connected in parallel therewith occupy an extremely small space, a variable tunable oscillatory circuit can in this case be arranged in an extremely small space. The space which this oscillatory circuit requires is so small that it can even be arranged in the base of an electron tube or valve. The variation of the tuning can, in this case, be effected in an extremely simple manner, since it is only necessary to provide on the coil an additional direct current winding so dimensioned that, with a core of given mass, it allows sufficient variation of the preliminary magnetisation. Since therefore, there need no longer be any direct mechanical contact between the oscillatory circuit to be adjusted and the tuning means, this method provides an ideal solution for the remote control of receivers. For the operator to tune the oscillatory circuit from any desired distance away, it is only necessary for him to vary the magnetisation by means of a variable resistance or the like for instance a rotary resistance or else a carbon compression resistance which, as is well-known, allows a smooth variation of resistance. This manner of varying inductance is very favorable also for the arrangement of tuned oscillatory circuit at place where a variation of tuning can be mechanically effected only with difficulty, such as for instance, within the vacuum space of an electon tube, since the oscillatory circuit constants are varied without mechanical means. This method of tune is particularly favourable in high-frequency amplifiers which work, for instance, with a choke-coil coupling. In such amplifiers, it is preferable, in order to reduce stray capacity to arrange the coupling choke coil in the interior space of the tube. Thus, for instance, in multiple tubes containing several systems coupled together, the coupling choke may be arranged with the tube in which case the wave band to be transmitted can be displaced at will from outside, simply by varying the preliminary magnetisation. However, the method is also useful for the tuning of ordinary series high-frequency amplifiers.

As has already been shown, when using three-limb transformers or similar arrangements which prevent coupling between the tuned and the tuning circuit, it is possible to remove any danger of mutual coupling taking place between amplifier stages when several amplifier stages are simultaneously tuned by connecting the preliminary magnetisation windings of all the amplifier stages in series or in parallel. In this manner therefore, it is easily possible to construct a set with single-knob manipulation. In order that variations of the preliminary magnetisation may act uniformly on the individual circuits to vary their tuning, it is possible by displacement of turns or groups of turns to pre-arrange that the individual preliminary magnetisation coil and the individual oscillatory circuit coil match one another as accurately as possible; alternatively, however, the cores per se themselves, which are rather soft can also easily be corrected for balancing purposes by cutting off particles or by deformation. Finally, it may be preferable to make the mass cores conical, whereby adjustment may be effected by adjusting the extent to which the mass cores enter each particular coil. Likewise, the small blocking condensers which serve for completing the oscillatory circuits may either themselves be rendered slightly variable by compression screws in order that adjustment may be effected, or else small variable condensers, similar to the well-known trimming condensers pro-

vided on ganged rotary condensers may be connected in parallel with the blocking condensers, to permit exact balancing.. The variation of the receiving ranges, in this case, may be effected either in the normal manner by the connection and disconnection of groups of turns or else by the parallel-connection of larger or smaller blocking condensers.

The construction of tuning variometers is also very much easier to carry out by means of ferromagnetic iron cores, since the coupling can be varied by changing the position of the coils to a much greater extent if the flux is concentrated by ferromagnetic cores. The various attempts to construct receivers which allow of receiving the whole wave band, by simultaneous variation of capacity and inductance, on a single revolution of the interconnected variable tuning elements, therefore, become much more promising here without having to resort to such dimensions of the condensers that strong damping and thus unfavourable reception results.

The method of automatic volume control already mentioned above can, of course, also be combined with the described method of tuning by varying the preliminary magnetisation, in which case very simple apparatus are then obtained in which both tuning and volume control are obtained merely by varying the preliminary magnetisation in different windings. Since very few mechanically moved tuning means are required, the invention provides ideal apparatus, particularly for remote control, since manual volume control can also be effected by variation of the preliminary magnetisation. An apparatus is thus obtained wherein single-knob tuning of almost any desired number of oscillatory circuit together with both manual and automatic volume control is merely by varying the current intensity of preliminary magnetisation currents, an operation which can be effected from any number of points located at any distance from the receiving apparatus. Such apparatus are particularly suitable in combination with amplifiers constructed in accordance with co-pending application No. 415,079. The use of saturating tubes in the anode circuits as described in the above application considerably simplifies the construction of the means parts of the apparatus and the decoupling arrangements, owing to the intense filtering action of these tubes against mains alternating current and also due to the mutual decoupling action of the individual stages, so that an extremely simple apparatus is obtained. In order, to prevent the emission from the cathodes, when using photo-cathodes in the saturating tubes from being dependent upon the general intensity of illumination at the receiving station, artificial illumination is of course used for this purpose. This can be obtained, for instance, in an apparatus which is provided with indirectly heated tubes having high voltage cathodes for direct connection to direct and alternating current, by using for the production of the artificial illumination that part of the mains voltage, which must be taken up in breaking down the mains voltage to the voltage required for the cathode operation. However, since mains fluctuations are manifested in a disturbing manner in this case by fluctuating disturbance of the photo-cathode current, it is desirable to use light radiators which are very inert thermally, such as for instance, lamps, constructed in the manner of the well-known Nernst lamp. This form of illumination is desirable in all cases where normal lamps cause excessive disturbances in cooperation with photo-cells, such as, for instance, in the reproduction of sound films etc.

By the combination of the above described tuning and volume control by variation of the preliminary magnetisation with the suggestion last mentioned, which are described in the present applicant's prior application above referred to apparatus are obtained which are of extraordinary simplicity and reliability. However, by employing the method of tuning based on a variable preliminary magnetisation, it may be difficult in some circumstances to cover a sufficiently large range of reception without the connection and disconnection of condensers or coil parts. In this case, the range to be received may be subdivided into a relatively large number of wave ranges in the manner described in copending application No. 409,737, in which case, as has been described in detail in the prior application, this sub-division has the further advantage that the balancing of several simultaneously tuned oscillatory circuits is substantially simplified, so that a particularly simple form of single-knob manipulation is thus obtained.

The variation of the preliminary magnetisation can also be employed even to obtain the adaptation of the mains transformer to incidentally occurring mains fluctuations or else to construct a mains transformer which can be employed without change of connections on different mains voltages. To this end the effective inductance of the core is varied by means of rectifier current from a secondary winding for instance, the current from the secondary winding supplying the anode current which must, in any case be rectified in such a manner that as the mains voltage increases, the secondary voltages decrease, at least in those windings where excess voltages are dangerous, that is particularly in the heating windings. A fluctuation of the anode voltage is generally not so detrimental, owing to the fact that the grid bias is usually produced at the present day by the voltage drop in a resistance, whereby the grid bias automatically adapts itself to the changed anode voltage and automatic control of the volume can be effected in any case. Hence, a small auxiliary transformer which merely supplies the heating current for the tubes, can be regulated by means of a main transformer, which supplies the anode voltage and the like. The tuning and regulation become very simple, of course, when superheterodyne receivers are employed, particularly of the kind according to prior Patent No. 301.498 and the addition thereto No. 313,414, since in this case only the tuning of single circuits is to be varied, which of course renders any type of balancing superfluous. Automatic noise suppression in combination with automatic fading compensation can also be obtained in simple circuits even with a pure form of magnetisation curve, since the curve exhibits a mean straight part, which would then serve for maintaining the sound volume within certain limits while the first flattening which occurs at the beginning of the curve may be used for noise suppression while the second flattening which occurs at saturation may be employed for the compensation of fading. In the same way, of course, the constructional examples described here primarily for fading compensation can be used for the correction of amplitude in sound film and sound disc recording and such cases.

The method of inductive tuning herein de-

scribed may be used also in the case of capacitative tuning, wherein a tuning capacity is used which is varied by a bias. To this end use may be made as tuning condenser of an arrangement such as an electrostatic loudspeaker, wherein by varying the bias the capacity is varied. The above description as applied to inductive influencing may then be read as applying to capacitative influencing.

A number of further possibilities which arise when using mass cores of the nature of Ferrocart material may be mentioned. In the first place, it is possible to obtain mechanical attraction of such cores as with normal alternating current magnets. This fact enables for instance, high-frequency relays to be constructed for use in transmitting and receiving circuit, particularly in receiving circuits, wherein a mass core attracts an armature of an identical ferromagnetic high-frequency mass. However, telephone receivers, loud-speakers, sound recording instruments and the like can then also be directly constructed, which enable direct conversion of high frequency oscillations into mechanical oscillations and vice-versa. Similarly voltmeters and ammeters adapted to be directly operated with high frequency, galvanometers, power meters, etc., may be constructed in which, however, the normal types of iron are replaced with such mass material. In this case, amplification of the action may be effected by introducing back-couplings, by means of discharge tubes or other amplifying means. Therefore, for instance, in a telephone, the mass core of which is directly energised by high-frequency currents, amplification can be obtained by the use of high-frequency back-coupling. Of course, low-frequency back-coupling would also be possible per se. Nevertheless, the high-frequency back-coupling in this case has the advantage that no appreciable distortion is introduced thereby. Since, however, as has been shown above, tuning may be effected by varying the preliminary magnetisation or the coil-spacings with respect to one another or to the iron core or the like, it is possible in this manner to combine both the tuning circuit and the reproducing instrument and possibly also a volume control all into one constructional element.

In the devices mentioned for the conversion of mechanical into electrical energy, it is possible, for instance, with sensing members, either to vary the coupling at more or less constant frequency by variation of the preliminary magnetisation or the like, or else to vary the frequency whereby the transfer of energy between two circuits is then varied due to the de-tuning between two circuits. The above suggestion for the construction of high-frequency instruments operating directly in high frequency by the method usual for low-frequency is also of particular application in directional reception, since in such apparatus the goniometers can then be constructed in like manner to soft-iron instruments. Thus, by more or less intense preliminary magnetisation, which can possibly be obtained by permanent magnetic fields, asymmetry of the magnetic fields may be obtained on change of direction of the high-frequency current, so that instruments can even be produced on the system of moving-coil direct current instruments.

By virtue of the asymmetry of the magnetic fields in the reversal of polarity of the current in a sufficiently pre-magnetised iron core, demodulations and modulations can also be effected with such mass cores. Therefore, such a mass core with corresponding windings and pre-magnetising coil etc. may also act as a demodulator in receiving circuits and thus fulfill the function of detector tubes. Since, for instance, in heterodyne receivers, two tubes acting as detectors are required then in such a case by means of the use of suitable coil or transformers, two tubes may be replaced by a mass core. This constitutes a considerable simplification. In order to replace the first tube, such an arrangement would have to act both as a modulator and demodulator, but in the second case, for the conversion of the intermediate frequency into the low frequency merely as a demodulator. Another tube is definitely required for the local generation of oscillations in heterodyne reception. Since, however, for the generation of oscillations work can be done on the straight part of the characteristic of a tube, then a low-frequency tube, preferably the output tube in reflex connection may be used for the generation of oscillation since in this case, owing to the great flexibility of control complications should least be expected. If the reflex system is also used elsewhere in such receivers, heterodyne receivers may be constructed with very few members. Since the tuning in such receivers can also be obtained by varying the effective inductance in accordance with the aspects given above, a receiver may be designed of a simplicity hitherto hardly known.

For the remote operation of receivers, it is important that the change-over of the individual wave bands should be effected with the same current as effects the variation in tuning. This can be effected in a simple manner by interrupting and re-inserting the current employed for varying the inductance or for volume control, the interruption and re-insertion electro-magnetically setting into motion in the receiver an escapement wheel which sets a wave-band changing shaft into rotation. Since, as above described the actual tuning circuit may be completely decoupled from the circuit effecting the preliminary magnetisation it is immaterial in which direction the preliminary magnetisation current flows. By means of a polarised driving mechanism for the escapement wheel the latter may be rotated, for instance, clockwise, on the passage of a current in one direction, while on reversal of the direction of the current the escapement wheel is moved in the anti-clockwise direction as the circuit is broken and remade. Therefore, by means of a suitable commutator switch arrangement in the remote controlling apparatus in cooperation with the escapement wheel mechanism described, it is possible to effect rotation of the wave band change-over switch in the actual receiving apparatus in either direction from the remote controlling apparatus.

Since, the direct current component of the anode current in the demodulation devices owing to the selectivity of the receiving circuits, varies with variation of the tuning when a given transmitter is being received, this current variation may also be employed for the subsequent automatic correction of the tuning, since the direct current component of the anode current can then be used to vary the preliminary magnetisation to effect correction of the tuning circuits. Hence, it is possible in this manner to construct automatic self-tuning apparatus, or apparatus, which one tuning is effected, automatically adapt themselves to variations of frequency of the oscillations received.

Since the inductances provided with mass cores

herein described may be used to replace modulation tubes, they can also be used in arrangements made in accordance with a prior invention of the present applicant to replace discharge tubes by inductance coils or transformers. In the arrangement for multiplex telegraph according to the prior invention use is made of two parallel tubes, the grids of which are energized in opposite phase by a local oscillation. These tubes can be replaced by corresponding transformers of the type herein described. In the prior arrangement relays are shown connected in the anode circuit of the tube. These can now be dispensed with, since the mass cores of the said transformers may themselves be designed as relays and so permit conversion of the oscillatory energy into mechanical energy directly. The arrangement according to the prior invention may also be used for the analysis of frequency mixtures, by applying a control frequency variable in accordance with a well-known law to the control grids, whereupon a pointer or the like connected to the relay armature employed therein gives a strong deflection when the control frequency conforms with the frequency of a component of the current mixture supplies to the anode circuit, by application of the principle herein discussed, the tubes may be replaced by mass cores provided with a suitable winding, and an instrument can therefore be constructed which acts directly as frequency analyser without the aid of discharge tubes, if a known variable auxiliary frequency is supplied. The different constructional examples indicated in the above application can be combined among themselves, so that an extremely large number of possibilities of use is obtained.

A further application of the invention relates to heterodyne receivers and more particularly those which are constructed in accordance with prior Patents No. 301,498 and 313,414, wherein an aperiodic input or, at least, an input which acts aperiodically over a part of the receiving range is employed as the mixing tube, this aspect of the invention, however, being in no way limited to these special types of receivers. In such receivers, one of the most important drawbacks is the strong crackling often complained of, which arises from the mixing tube and is then amplified to large amplitudes by the subsequent, usually powerful, intermediate frequency amplification. This amplification following the frequency changer was previously desired when difficulties still existed in the amplification of short waves. At the present day, these difficulties are obviated to a great extent, and it is therefore now proposed to arrange the entire amplification before the mixing tube, whereby the noises arising in the mixing tube can be rendered small in relation to the receiving oscillations which reach this tube already fully amplified: In this case, of course, it is immaterial whether the amplification is effected by discharge tubes or by a back-coupling effect.

In addition to the suppression of the crackling tendency, however, other, considerable, advantages are also obtained by means of this arrangement. For instance, a finer anode rectification can easily be used, since the amplitude of the receiving oscillations applied to the control grid of the mixing tube after amplification can in any case be made so large that work is no longer done on the changing curvature at the lower bend of the characteristic, but the half-waves to be rectified extend into the straight part of the characteristic, so that a linear instead of an exponential action results, which is desirable for many cases. However, it is also advantageous in this receiver to employ the recent mixing arrangements employing pentagrid or hexode tubes such as described in copending application No. 409,756 with multiplicative instead of the additive or subtractive intermediate frequency formation. Since, in accordance with the present proposal it is important to avoid any considerable amplification after the mixing tube, it is also desirable to avoid subsequent powerful low-frequency amplification. In may therefore be preferable to apply the output from the rectifier directly to the loud-speaker or even, as described above to dispense with all low frequency parts and allow the high frequency to act directly on an electrostatic or electromagnetic high frequency loud-speaker (provided, for instance, with Ferrocart-like mass cores). Between the rectifier or high-frequency loud-speaker and the mixing tube in place of the usual intermediate frequency amplifier, merely an intermediate frequency filter chiefly comprising several members should be arranged which may be constructed in a manner well-known per se as a chain conductor or may comprise mechanical resonators such as quartz crystals.

Particularly if, aperiodic or semi-aperiodic input circuits are employed as suggested above, it is desirable to use for the amplification effected before the mixing tube, tubes or combinations thereof according to copending application No. 415,079 since these tube combinations provide very high amplifications in combination with relatively low internal tube resistances. This is an important point in aperiodic or semi-aperiodic amplifiers owing to the relatively low dynamic resistances which may be given to such circuits for the adaptation thereof to the tube resistances. As has been mentioned in the last-mentioned application, in the case of high-frequency amplification, such series-connected tubes must be arranged so that the capacity of the connecting leads of the successive systems, is as low as possible, and to this end tubes with indirectly heated cathodes, which eliminate the capacity of the heating current source, and multiple tubes which keep the capacity of the connections between the individual systems low, are employed. If several systems are used in this manner, the construction of a multiple tube may become rather complicated and thereby give rise to a large quantity of waste. In this case therefore, instead of combining the whole in a single multiple tube it is desirable to provide each system or small group of systems in a separate tube, but to construct individual tubes so that they can be connected one to another with supply leads led out directly instead of through a base, so that in practice the advantages of the short direct connections provided in multiple-tubes are obtained but in manufacture the advantages of the production of single or two-system tubes exist, the tubes being combined at will into multiple-system units.

Since, when using a comparatively large number of series-connected systems, vary high voltage amplification is obtained and also since an anode current source, i. e. say, the mains-transformer etc. is designed for operation on high voltage and relatively small current, this type of apparatus is particularly suitable for combination with electrostatic loud-speakers.

In these methods of reception with aperiodic

or semi-aperiodic input circuits, there is the advantage already emphasized in the prior patents referred to that single-knob manipulation is thereby obtainable in a very simple manner. It is very desirable for the constitution of these circuits to use coils wtih ferromagnetic cores at least for the construction of multi-element filters in order to avoid stray fields and in consequence undesirable couplings, and if this is done it is possible to go a step further and, by the use of an adjustable preliminary magnetisation to use these ferromagnetic cores in the manner above described in place of rotary condensers, for tuning in to various waves to be received. The difficulties with this method of tuning, i. e. by preliminary magnetisation, in the case of a plurality of tuned circuits arise from the necessity of keeping the individual circuits in resonance over the entire receiving range, and these difficulties are avoided here, since when using aperiodic input circuits, only one continuously variable tuning means is provided and when using semi-aperiodic input circuits, the necessity of observing absolute accuracy of the tuning between the individual circuits is dispensed with.

The necessity for accuracy of tuning can be still further reduced in the latter case by dividing the total wave range into a large number of small ranges according to copending application No. 409,737. In particular, if several simultaneously tunable circuits with variable permeability tuning are provided, this is of advantage. With this type of tuning, which is particularly suitable for the remote control tuning of apparatus, the design of the tuning scales at the receiving apparatus or at the individual remote-operating place can then also be very conveniently designed. Since in this method of tuning as already described in copending application No. 409,737 the delicate mechanical adjustment is replaced by a form of electrical vernier, a very simple mechanical equipment is sufficient at the individual remote-operating places.

The tuning scales are preferably constructed as "panel-scales." At the front of the receiving or remote control apparatus there is provided a plate of, for instance, milk glass of suitable dimensions (say 10 by 20 cms) which is divided into horizontal and vertical strips. If the plate is placed crosswise, strips are obtained which owing to their elongated form, are of suitable shapes for the inscription of station names. Each column then corresponds to one of the relatively small wave bands and the individual strips constituting a column correspond to the individual stations to be received within this band. The scale may be illuminated from the rear and there may be arranged on the apparatus as a wave switch, a plane sliding switch, the switching arm of which is movable behind the scale in such a manner that when connection is made for the reception of the shortest wave band, it is situated just behind the horizontal row which corresponds to the shortest band and, when the wave band connection is changed it comes into the corresponding position behind the wave band now switched in. If a small lamp is fixed to the switching arm, the range switched in at any time is always illuminated. By means of the knob effecting the tuning within a selected range, the lamp may then be moved to and fro in a vertical direction behind the scale plate on a runner or the like, so that the strip bearing the name of the station being received is then illuminated. Alternatively a long horizontal pointer may be provided which moves in front of or behind the scale and which indicates the station in the column illuminated at the time, to which the apparatus is tuned. Such a panel scale, as will be hereinafter described can also be suitably constructed for use at a remote-controlling post.

Remote tone control by the variable induction of presaturated low-frequency chokes or transformers may also be employed.

The remote tuning mechanisms herein dedescribed are, of course not limited to the provision of a panel scale as herein described any more than the panel scale is limited to this manner of application, since it is suitable generally on sub-division into a larger number of individual ranges, particularly in the arrangements according to the prior patent application No. 405,737 above mentioned. The methods of execution of the limited tuning or operation herein described are not only applicable to the special methods of reception described here and in the last mentioned application although they are particularly suitable therefor.

The method according to the invention, can be used with very great advantage for yet another element in the tuning of a set, namely, not for operation of a continuously variable tuning element i. e. for replacement of the rotary condensers, but may also be used to replace the step-by-step tuning of an inductance by wave change switches. In this case, special advantages are obtained. As is well-known, it is a great disadvantage of all apparatus working with a wave change that change-over switch contacts must be provided in the high-frequency circuits, since, firstly, the connection of the lines from and to the contacts causes difficulties, since all capacitative effects in such circuits are to be avoided to the greatest possible extent. In addition, the lines to the change-over switches and the change-over switch contacts give rise additional dampings, apart from the undesired capacitative couplings, and finally also the mechanical structure of these multiple switches is complicated and expensive.

All this can be avoided by the step-by-step switching or pre-magnetising currents, which offers great advantages, in particular, when a large number of changes of connections is to be effected, such as, for instance, in an apparatus constructed according to copending application No. 409,737.

All tunings effected by saturation such as hereinbefore mentioned and more particularly, those just discussed permit in other respects the use of much higher permeabilities than, for instance, are obtained with the Ferrocart-like materials, wherein during operation, the inductance value remains unchanged. This is due to the fact that in the case of the materials the permeability of which remains unchanged, the permeabilities must be so chosen that even at the smallest wave length arising, the damping is not too great, whereas in carrying out the present invention, the permeability is so chosen that in the condition of the maximum preliminary magnetisation, the permeability is a minimum, the damping is kept within the desired normal limits for the smallest wave lengths while in the case of higher wave lengths at which a higher permeability does not bring any objectionable increase in damping, this increased permeability can then also be effectively utilised. This applies particularly to the step-by-step inductance switching here described, since here the maximum permeability comes into action at wave lengths which behave particularly favour-

ably as regards the damping with ferromagnetic cores.

The step-by-step tuning by varying the current intensity or voltage of a pre-magnetising current in steps may even be used in the case, owing to its special advantages, in arrangements which are otherwise normally tuned, that is tuned by rotary condensers or variometers or in combination with the methods of tuning hereinbefore described, so that the step-by-step and also continuous tuning can then be effected by the same or even different preliminary magnetisation coils on the same or on different cores.

It is also very suitable, particularly for remote tuning, however, to combine the continuous tuning (described above) with a step-by-step tuning by variable preliminary magnetisation by means of electric biassing of condensers, for instance, Seignette salt condensers, for the purpose of remote operation of receiving installations having several tuning circuits by a single-knob.

In particular, for such cases in which a high degree of curvature of the magnetisation curve is desired in addition to a high degree of variation of the permeability at the working point, that is, especially in those cases where a modulation phenomenon is desired, there is a certain drawback with cores such as Ferrocart cores, having a fine subdivision in the distribution of direction of the lines of force, the magnetisation curve presents only slight curvatures. According to a feature of the present invention therefore, a magnetic core is provided which is hereinafter described, and which has proved to be particularly suitable in such cases, and also in all the other cases which are mentioned in the main application.

Since very sharp bends can be obtained in the magnetisation curve even with relatively small magnetomotive forces, if the ferro-magnetic material is suitably chosen, this material is also particularly suitable for the construction of magnetic amplifiers which operate on the principles well-known per se, such amplifiers could only be constructed for relatively low frequencies in the past, owing to the high iron losses.

In order that the various aspects of the invention may be more clearly understood, a number of embodiments thereof will now be described with reference to the accompanying drawings in which,

Fig. 1 shows a simple volume control arrangement.

Fig. 2 shows a modified form of volume control arrangement similar to that shown in Fig. 1.

Fig. 3 shows an arrangement for obtaining automatic volume control.

Fig. 4 is still another form of volume control.

Fig. 8 shows diagrammatically the circuit arrangement of a superheterodyne radio receiver embodying a feature of the invention.

Fig. 9 shows a tuning indicator arrangement and remote controlling apparatus for use in conjunction with the invention.

Fig. 10 is a remote control circuit which may be employed, according to the invention, in conjunction with the other remote control arrangements described.

Fig. 7 shows an arrangement for effecting step-by-step alteration of an inductance.

Fig. 6 is an elevation and

Fig. 5 a section of a form of core suitable for use in carrying into effect the various features of the invention.

Referring first to Fig. 1, which shows a volume control arrangement a tube 1 is shown adapted to operate, for instance, as an anode current rectifier, so that an increased amplitude at the grid, produces an increase in the anode direct current component. An oscillatory circuit 2 is connected to the grid of the tube. The anode circuit of the tube is provided with a back-coupling coil 3 and variable leak condenser 4. According to the invention, the back-coupling coil is coupled to the oscillatory circuit through a ferromagnetic core 5, the inductance of the ferromagnetic core being of such a value that favourable operation of the back-coupling is just obtained with the preliminary direct current magnetisation due to the anode current which passes at the desired volume. The adjustment of such a close back-coupling is effected by means of a variable condenser 4. If the capacity of the condenser 4 is made very large the high frequency component is mainly conducted to the cathode without traversing the coil 3 and a slight back-coupling action takes place, while on the other hand, if the capacity is reduced, the back-coupling effect increases. If strong signals are now received, which cause a substantial increase in the anode current, the action of the back-coupling decreases accordingly since the increased preliminary magnetisation reduces the mutual inductance of the coil 2 and 3. The reverse action may also take place. In this case, therefore, a very simple type of volume control is obtained. Any de-tuning of the circuit 2 which occurs may be compensated in any suitable manner if it is undesirable, although as stated above, additional volume control may be obtained thereby. Any desired adjustment of the time constant of the regulating operation can be obtained by condenser and resistances or the like, suitably incorporated in the anode circuit.

In Fig. 2 a modification of regulating device for the regulation of back-coupling is illustrated, which has an even more intense action to some extent. In this case, a three-limb core of ferromagnetic material is provided, which carries three different coils or groups of coils. The coils 1, 2 are connected in a tunable oscillatory circuit, which may be connected to a tube acting as rectifier. These two coils are wound in such a manner that the field they generate in the coil core are in series. The field produced by them, therefore, does not substantially penetrate the centre limb of the transformer. On the centre limb of the core there is arranged a coil which is traversed by the high-frequency components of the anode current of any succeeding high-frequency amplifier or the detector tube to which the oscillatory circuit 1, 2 may be connected. As long as the inductance in the two symmetrical portions of the three-limb transformer I and II is uniform, no back-coupling effect will occur at all, since the oscillatory circuit is decoupled from the back-coupling coil in this condition. The core of ferromagnetic material or the oscillatory circuit coil may be so designed that complete mutual decoupling occurs when a certain normal current flows through the turns 3, 4 connected in opposition to one another, which are traversed by the direct current component of the de-modulation tube. If the volume falls below this desired degree, then the consequent reduction in the preliminary magnetisation by the two coils 3, 4 unbalances the symmetry in the two magnetic circuits I, II so that coupling takes place between the oscillatory circuit 1, 2 and the back-coupling coil, such coupling being intended to set in such

a manner that the back-coupling coil has an amplifying action. If, however, the field strength of the incoming oscillations becomes very great, so that the anode current in the rectifier tube considerably increases, the symmetry of the arrangement is displaced in the opposite direction and the back-coupling coil now acts additional damping, that is reduces the volume. For this effect to be produced, of course, it is necessary that initially, that is, without the action of the coils **3**, **4** a symmetry exists between the circuits **1**, **2**, so that a close back-coupling is then already present, thus a symmetry being gradually removed, as the direct current in the coils **3**, **4** increases, extended increase in the current in the coils **3**, **4** leading to asymmetry in the opposite direction. The arrangement just described owing to mutual compensation of the action in the coils **1**, **2**, provides automatic volume control without any variation of the tuning.

A third example of an arrangement providing automatic volume control is shown in Fig. 3. In this case, the coupling per se is varied in place of the back-coupling. I is, in this case, the input circuit of a coupling arrangement, while II is the output circuit. The arrangement may be a transformer coupling two high-frequency amplifier stages or the like. As can be seen, the transformer has 3 groups of windings, namely, a coil **1** which is connected to the input circuit, a centre-tapped coil **2** from which the output circuit is so derived that, if the coil is tapped symmetrically no oscillatory energy can reach the input circuit and, furthermore, a second two part winding **3**, **4** through which the direct current component of the demodulation tube flows. In this case also the tapping of the coil **2** may again be made asymmetrically at the outset or the mass core may be asymmetrically designed or both, so that normally, without direct current in the windings **3**, **4** or with only a small direct current component, a considerable asymmetry is present, whereby an essential part of the input at I may be derived at II, while as the preliminary magnetisation by the coils **3**, **4**, increases the asymmetry is gradually removed and finally the bridge or the differential system, on very strong preliminary magnetisation, gradually approaches balance, so that the current component which is transferred from I to II continuously diminishes.

If the coils **1** and **2** are parts of tuned coupling transformers between individual amplifier stages, where the de-tuning may be undesirable, this detuning may be counterbalanced, as has already been described in connection with the example shown in Fig. 2 by the counter-connection of similar elements so that no undesired de-tuning of the circuit then occurs.

The great advantage of such volume control arrangement resides in the fact that although no special tubes and no special grids in the tubes are employed, a variation of the volume can be obtained, which, in multi-stage apparatus, such as multi-stage amplifier, where a regulating stage may be arranged before each amplifying tube, multiplies the action in the individual tubes, and so allows of obtaining regulation within very wide limits. In the arrangement described in Fig. 3 wherein the preliminary magnetisation only acts to vary the energy transmitted from circuit I to to circuit II it is also possible since there are no tuning problems in this case to effect the regulation in the low-frequency part or else in the high-frequency and low frequency part together. If the regulation is effected in the low-frequency part, it is possible to dispense with the use of special types of iron.

A further development of the invention idea is shown in Fig. 4. In this case, I is again the input circuit of a coupling arrangement which is variable for the purpose of volume control and II the output circuit. **1** and **2** are normal fixed inductance coils, while **3** and **4** represent two inductances variable by preliminary magnetisation. The bridge arrangement comprising the four resistances **1**, **2**, **3**, **4** is initially balanced, that is, when only the preliminary direct current magnetisation by the battery **5** is effective in the coils **3**, **4** and there is no preliminary magnetisation by the centre tapped coils **6** and **7**, then the bridge is in equilibrium. If preliminary magnetisation arises in the coils **6** and **7** the equilibrium of the bridge is disturbed, since the inductance of the coil on the core **3** is increased and the inductance in the coil **4** is decreased to equal extents. A considerable flow of current will then take place in the arrangement from the input part I to the output part II. The preliminary magnetisation of the cores **3** and **4** is effected by the following manner. The two tubes **8** and **9** again represent rectifiers, which are energised by an oscillatory circuit **10**, which may be assumed to be connected to the output of a high frequency amplifier. The circuits I and II may be the coupling between two or more stages within this high-frequency amplifier. The tubes **8** and **9** then, act as rectifiers and in the present figures, for the sake of clearness, the part of the lines which leads to the low-frequency amplifier is omitted and only that part of the lines of the anode circuit of the tubes **8** and **9** is shown, which carries direct current. In this case, means, not shown, may also be provided which effect the filtering of the alternating current component.

The two tubes **8** and **9** are intended to work with somewhat different biases, e. g. tube **8** with normal negative bias, so that it acts as a normal anode rectifier tube, and the tube **9** with so great a negative bias that the tube begins to function only at considerable amplitudes. When signals of very low intensity are received, so that it is to be feared that the material part of the audion only comprises strongly reproduced disturbances, then owing to the small anode direct current of the tube **8** and the tube **9** in the coils **6** and **7**, no appreciable direct current at all will flow, so that, the original equilibrium of the bridge is not disturbed and practically no output is transmitted from I to II, that is, not even the intense disturbing noises, which are otherwise always present as a disturbing factor in a sensitive receiver on adjustment to maximum volume. If signals of a moderate sound intensity occur, the anode direct current of the tube **8** increases and, hence an increasing magnetisation is produced in a half of each of the coils **6** and **7**, which as has already been mentioned, act in the opposite sense on the cores **3** and **4** so that in one core the preliminary magnetisation proceeding from the battery **5** is increased and in the other, it is decreased. Thus the equilibrium of the bridge is disturbed and a good transmission of the energy from the input circuit from I and II is effected. If the signal intensity considerably increases the tube **9** will also come into action, so that if the signal amplitude becomes greater than the negative bias of the tube **9**, this tube then also passes an anode direct current. Hence, anode current is now supplied to coils **6** and **7** from both tubes **8** and **9**. Since the two halves of the coils **6** and

7 act in opposition to one another, however, simultaneous operation of the tubes 8 and 9 acts to remove the preliminary magnetisation in the coils 6 and 7 and the bridge is again balanced so that the amount of energy which is supplied from the input circuit I to the output circuit II is kept constant.

Here again therefore an arrangement is provided, wherein automatic volume control and automatic noise suppression is provided. The coil combination shown here can also be arranged in several stages of a multi-stage high-frequency amplifier or even a low frequency amplifier, so that regulation within very wide limits can take place. In this case, it is note worthy that the input circuit I can be tuned, since the total inductance of this circuit (if no considerable load is applied to circuit II, that is, for instance, only the input of a tube amplifier) does not vary. The total inductance consists of two part-inductances connected in parallel, i. e. the part-inductance of the coil 1 in series connection with the iron-core coil 3, and, the part inductance of the coil 2 in series with the iron core inductance 4. Since, however, in the regulating operation, the inductances of the coils 3 and 4 are varied in opposite sense, then provided this variation takes place to some extent in a linear manner, as may be contained within wide limits of time by a suitable coil and core arrangement for instance, conical iron cores or the like may be used, the total inductance will not vary during the regulating operation, so that these coils may be parts of a tuning circuit.

Referring now to Fig. 8 this shows a super-heterodyne radio receiver constructed according to a feature of the invention. As is readily apparent from the drawing, the apparatus comprises two stages of series connected amplifier tubes, each comprising two tubes 21, 22 and 23, 24 connected in the manner according to co-pending patent application No. 415,079 the two stages are coupled through a band-pass tuned circuit 25. The output of the two stages of high-frequency amplification is applied through a further band-pass tuned circuit 16 to the mixer tube 27 shown as a hexode or four-grid tube. The intermediate frequency from the mixer tube 27 is applied by way of transformer 28 and filter 29 to a second detector 30, in the anode circuit of which the loud speaker L is connected.

The high-frequency signals picked up by the aerial 31 are amplified in the two stages of high frequency amplification to such an extent that, after frequency changing by the tube 27 and detection by the tube 30, a sufficient output is derived to drive the loud speaker L without low frequency amplification.

Preferably, the tuning arrangements are constructed according to co-pending patent application No. 409,737, whereby the condensers forming part of the coupling circuits 25 and 26 and the tuning condenser for the local oscillation generating circuit 32 may all be ganged together without difficulty and may even be condensers of the solid dielectric type.

In Fig. 9 a further development of the invention is shown. In this figure, T is an instrument which is traversed by the premagnetising current and indicates its strength. However, since this current, is proportional to the receiving frequency, the instrument can be directly calibrated in wave lengths. By means of a second lever pivoted at D, a parallel ruler mechanism is formed whereby the long pointer Z may be maintained horizontal and guided up and down in front of or behind a panel scale divided, for example into five parts. Connected in series with the instrument T is a regulating resistance R, which enables the intensity of the pre-magnetising current and thus the tuning of the receiving apparatus to be effected. The resistance R is operated by a knob K which is mounted on a long spindle, which may be of square or other cross-section so that on rotation of the knob, the contact arm of the resistance regulator R is turned, but on movement of the knob in the direction of the spindle, the latter may slide freely.

The spindle A may therefore be used to displace the contact Y on the slide S by push or pull, so that it can be brought into engagement successively with the contacts 1—6. This contacting causes circuit interruptions or closures which cause the rotation of an escapement wheel in the receiving apparatus in the manner described above, said wheel causing the wave range change-over in the apparatus.

In this case, pressure on the knob K in the axial direction, moves the member M sliding frictionally on the spindle to effect a contact closure between the elements of the controlling apparatus and the lead U, while a pull on knob K, moves the member M in the reverse direction and makes contact between these elements and the lead V. The individual current impulses produced by contact of the contact Y with the individual contact points cause rotation of the escapement wheel effecting the wave range change in the apparatus in either one or the other direction, according to whether the impulses are transmitted to the receiving apparatus through the lead U or V, since the two lines U and V are connected either to two different lifting magnets or drive a polarised escapement wheel mechanism in either direction. The result is thus obtained that the position of the escapement wheel corresponds at any time to the position of the contact Y.

On the contact Y there is arranged a small lamp *La* which illuminates the area below which the contact for the time being in operation is located. The arrangement is preferably so devised that by means of vertical screens or the like, the adjacent fields are prevented from being noticeably illuminated also only the one area corresponding, to the wave band in use being illuminated, and the shadow of the long transverse pointer Z being devised on the milk glass or like plate only at that locality. The sixth contact point is shown in the present constructional example as an idle contact, so that by shifting the knob K into its end position, the apparatus can be switched off by interrupting the current interruption. It is preferable to ensure, by means of resilient stops or the like, that the contact cannot remain in an intermediate position between two contact points. Furthermore, a change-over to gramophone reproduction for instance, at the receiving apparatus, may be distinguished at the remote-control apparatus by reversal of the direction of the current or the like or by means of a special signalling lamp or by deflection of the instrument in the opposite direction, whereby the pointer is moved out of the range of the tuning scale and replaced by a template with an inscription which is depicted on the scale.

If remote control is to be effected from more than one point, the remote control line may be permanently connected up to the several points

(if a movable wire is not employed) and plug connections may be provided at these points into which a remote control apparatus of the above-described kind can be plugged. It is then only necessary for instance, in a dwelling-house with several living rooms—from which the operation is to be effected at will, to carry about the small and light remote-control apparatus to the room from which control desired. Alternatively a remote control apparatus may be permanently installed at each point which shows on permanently connected ammeters or voltmeters, which are calibrated in wave lengths in the above described manner, the wave length adjusted at the time from that or another place. In the latter case, however, it is preferable to provide a locking arrangement, whereby an adjustment cannot be made from one point if the apparatus is already being controlled from another point, since otherwise the escapement wheel mechanism in the apparatus might fall out of step. The connection and disconnection of the apparatus, however, can be effected in this case from any number of points by means of a circuit similar to the "series circuit" in lighting installations.

The individual operating points can be made more dependent of one another by the following arrangement. Means such as a holding magnet as used in the selectors for automatic telephones may be provided arranged on a device which may resemble the above-described remote control, which holding magnet, retains the knob K by means of a braking action of by a pawl and stops, in each position into which it is placed by means of the adjuster, in opposite to a restoring force formed e. g. by two springs. If the current is interrupted, the holding magnet or the holding magnets become currentless and the two springs i. e. a torsion spring and a lifting spring acting as restoring forces, rotate the resistance R into its zero position or initial position in which the circuit is broken, and move the contact Y onto the idle contact 6. Since, by the use of a "series circuit" as in illuminating installations the current interruption can take place at any operating point, this provides a possibility of effecting the operation at each point independently.

In this case, as described above, the reading instruments may remain connected at each point if desired, in order that the station to which the apparatus is adjusted may be observed at each point. If several wave bands are employed, a device must also be provided to indicate the particular wave band. This could be effected, for instance, by the arrangement of a separate signalling lamp under each scale section corresponding to a wave band, the lamps corresponding to each section being connected in series or in some other interconnection with the corresponding lamps at the other operating points. Loudspeakers may be permanently installed at the individual operating points or may be plugged in, in the same manner as the remote control apparatus. Alternatively a loudspeaker may be incorporated in the transportable control apparatus. When the apparatus is to be employed as a gramophone connection the changing of discs will necessitate providing the sound pick-up at the remote points, and talking-machine connections may therefore be provided at these remote controlling points, in which case care should be taken in the manner described above that the use of the apparatus for the time being as a talking machine is indicated at the other operating points.

The method of remote control above described, is not, of course, confined to its use for living rooms but may be used also when for any constructional reasons, the apparatus to be operated must be arranged at a place, which is inaccessible to the operator, thus for instance, on automobiles, aircraft, boats and the like.

In such cases also it may happen that the operation is to be effected either from the pilot's or driver's seat, or alternatively from the back seats, in which case at least two independent operating posts, should also be provided. This arrangement of independent operating posts may be effected in the manner already described or else by connecting all the lines concerned to each operating post as in a house telephone line-selector.

A further possible arrangement for independent operating posts is shown diagrammatically in Figure 10 by way of example. In this figure two such posts, are shown, in an installation such as for a motor-car wherein the apparatus is to be controlled from the back seats or from the driver's seat alternatively. The principle of the arrangement consists in using resistance branches, wherein by adjustment of regulating resistances, potentiometers or the like at different controlling posts, voltages or current intensities for the preliminary magnetisation may be derived. By this arrangement adjustment at one controlling post need not be varied or brought into the condition of rest before another controlling post can be employed, this result being achieved by the fact that the current consumers of the regulating resistances or the like which are provided at the various controlling posts are connected in a common circuit. Referring to Fig. 10 B is the current source required for obtaining the preliminary magnetisation, for instance, the battery of the motor car. The pre-magnetising winding in the apparatus, should be so arranged that the whole wave band for the time being connected up may be covered by variation of the voltage from zero up to half the available battery voltage. In other respects the windings may be constructed in all respects in accordance with the information set out above. The voltage applied to the pre-magnetising windings may be read off at either of the two controlling posts I and II from a voltmeter V1 or V2 calibrated in wave lengths or frequencies or station names, permanently connected in circuit. In the position shown, the sliders of the two regulator tappings R1 and R2 are approximately at the centres of their corresponding resistance strips. In this position they both have the same potential and zero voltage is therefore applied across the winding S connected between them. The longest wave is therefore tuned in. If one slider R is moved out of its position of rest, then independently of the position of the other slider, at least half the battery voltage may be applied to the winding S. The fact that, in this arrangement the direction of current may change is immaterial for the effect, since the winding S is completely decoupled. However, it is necessary to use voltmeters V, which give the same pointer deflection whichever the direction of the current unless opposite deflections are expressly desired for special purpose. The wave range change, however, can not be effected by means of change of direction of current and polarised escapement wheel mechanism, but must be effected in some other manner,

such as has been described above. The connection and disconnection may also be effected independently of one other at the control posts by "series-connection." Very often, a volume adjustment is required which may also be effected in the manner described above by means of saturating windings or in the same way as the tuning by electrostatic biasing of condensers dependent on voltage (for instance, Seignette salt dielectric condensers).

Turning now to Figure 7 this figure shows by way of example an embodiment of a further feature of the invention according to which the step-by-step variation of an inductance is effected by step-by-step variation of the preliminary magnetisation applied to a core with which said inductance is provided. In this figure, B is the current source, employed for preliminary magnetisation, which is shown here as a battery, but which in most cases will be replaced by a connection to the mains. R is a resistance variable in steps, which however, if continuous tuning by saturation is to be obtained in addition, may also have a continuously variable regulator connected in series therewith. Alternatively the resistance R may be continuously variable between the steps, and may be provided with stops, so that sub-division into several separate wave bands, even with a large tuning range of an apparatus, for instance from 200 to 2000 metres or more, is then dispensed with. K is the ferro-magnetic core which carries the relatively de-coupled premagnetising and oscillatory circuit windings. Further oscillatory circuits or back-coupling circuits of the apparatus, not shown here for the sake of simplicity are connected to the terminals X. Finally, Z is an additional resistance regulating arrangement the value of which may be adjusted to balance the initial values pre-magnetisation of the individual cores against one another; if the pre-magnetising windings of the cores are connected in parallel and not in series as shown here, the additional resistances Z should not be arranged in parallel but in series with the pre-magnetising turns.

Finally, Figs. 5 and 6 show diagrammatically a form of core, particularly suited to the various purposes of the present invention. Referring to these figures **11** is a coil body of thick pasteboard or other insulating material, which serves not only as a former for the coil, but also to ensure that the winding on the core is sufficiently spaced from the conductive cores material, at least, where it is desired to provide a high-frequency winding whereby disturbing capacity couplings through the core material are to a great extent avoided. The coil former, which is shown homogeneous in the drawing may also be in the form of a framework structure, so that the H. F. turns touch the insulating material only at a small number of points, a sufficient air spacing for the reduction of capacitative noises being provided elsewhere. Since the finished core in the form herein described forms a self supporting whole, the insulating former can therefore be mechanically relieved to a great extent.

On the coil former there is wound a layer of thin ferromagnetic wire, for instance, iron wire or better an alloy such as permalloy, in such a manner that a small air-space is left between the individual turns, which considerably reduce capacitative coupling between the individual wire turns. The thickness of the wire should not greatly exceed a diameter of 0.03 mm., thinner wires being still better.

After a layer of wire has been applied in the manner described, leaving sufficient spacings between the individual wires, this layer is preferably fixed and coated by a lacquer of good insulating qualities and of the lowest possible dielectric constant. Following this is an insulating layer, such for instance as paper, which is also fixed and then again, in the same manner as has just been described, another layer of wire or strip is applied. The wire or strip may possibly be produced electrolytically by deposition on a conductive base which is then dissolved away.

In the drawings **12** denotes the intermediate paper layer, and **13** the individual wires; **14** shows the arrangement of a layer of the H. F. coil winding. Since the core, as mentioned above, has sufficient mechanical stability after hardening of the lacquer, a direct current winding which is necessary for obtaining a preliminary magnetisation may be wound directly on the core. Hence, at the point where the direct current winding is arranged, the coil former is preferably removed since no reduction of the capacitative coupling is required, and a highly desirable gain in winding space is obtained.

Owing to the relatively low iron or the like content of the core, the permeability of course becomes considerably less than in massive cores or cores normally made of stratified material, but this is desirable for high frequency purposes owing to the consequent reduction in iron losses to tolerable limits. Moreover, sufficient saturation can be obtained in the matter with less current.

If the preliminary magnetisation is not produced by an applied winding but by arrangement of the core in the field of an additional permanent or electro-magnet, then of course by removing the insulating body at the particular points, provision should be made for good magnetic contact where the flux enters and leaves the core.

The cores described can be most simply produced economically in the form of closed circular rings since they can then be made on a simple coil winding machine with an arrangement well-known per se for the arrangement of intermediate paper layers between the turns, and it is therefore desirable to use two such cores for carrying out the various connection hereinbefore described. The direct current winding may then comprise two separate windings each arranged on a core, instead of the single winding illustrated in the figure. This last form of construction should even be the better one in regard to the attainment of a favourable filling factor.

The direct current winding and alternating current winding may generally be interchanged.

It has furthermore been mentioned above that the statement made for inductive operations when using cores of ferromagnetic material may also be applied to capacitative operations when using condensers dependent on voltage. Suitably constructed Seignette salt condensers are particularly suitable as such condensers.

This application is a continuation-in-part of applicant's co-pending application, Serial No. 749,088, filed October 19, 1934.

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DEVICES FOR REGULATING RADIO
SETS AND THE LIKE
Filed March 4, 1940

Serial No.
322,193

7 Sheets-Sheet 1

Fig. 1.

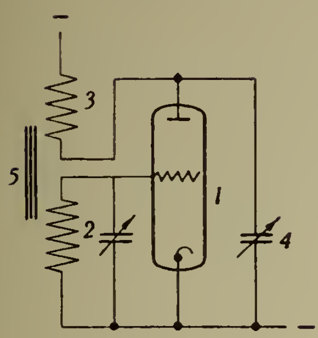

Fig. 2.

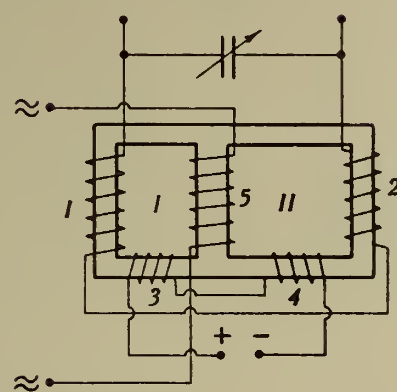

Fig. 3.

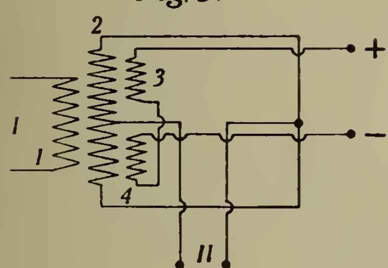

Fig. 4.

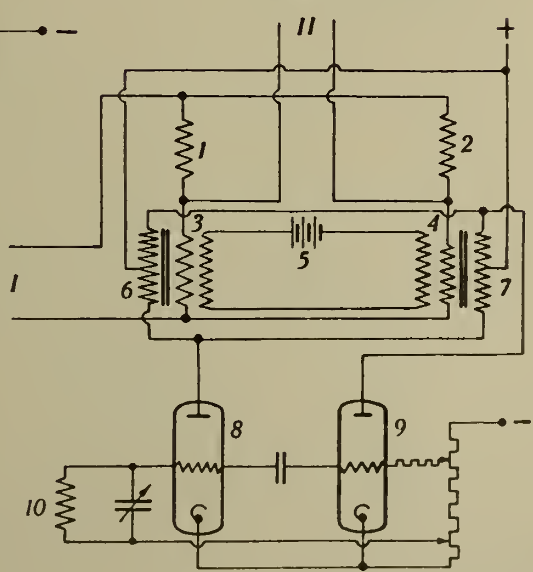

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Fig. 7.

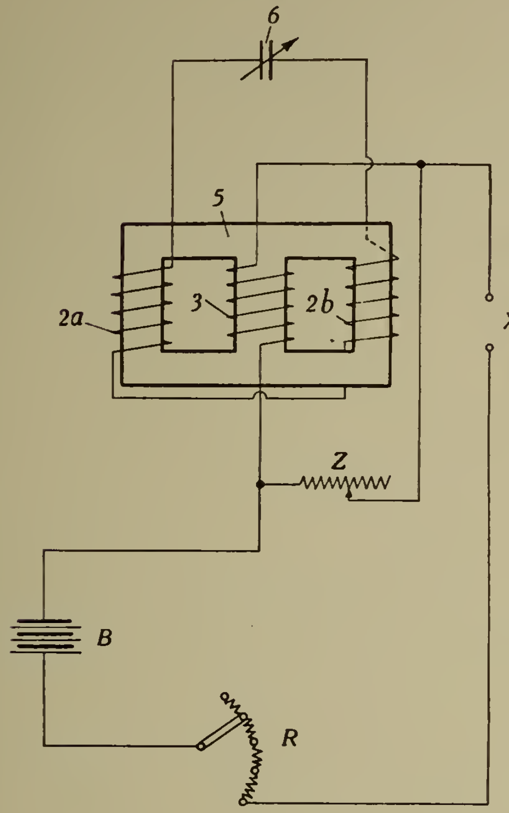

Fig. 5.

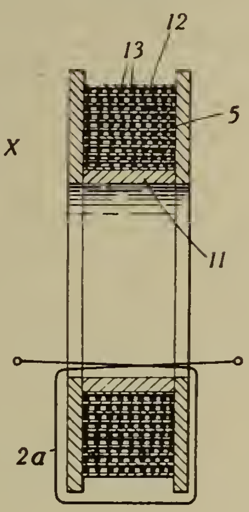

Fig. 6.

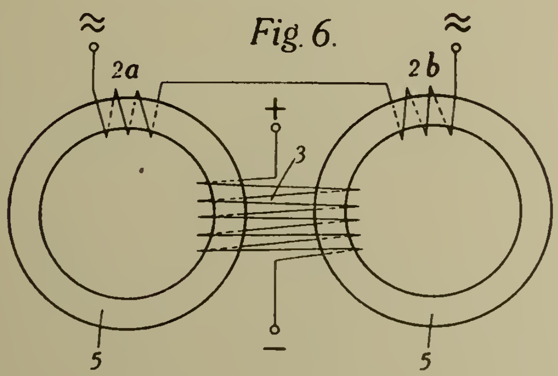

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Fig 8.

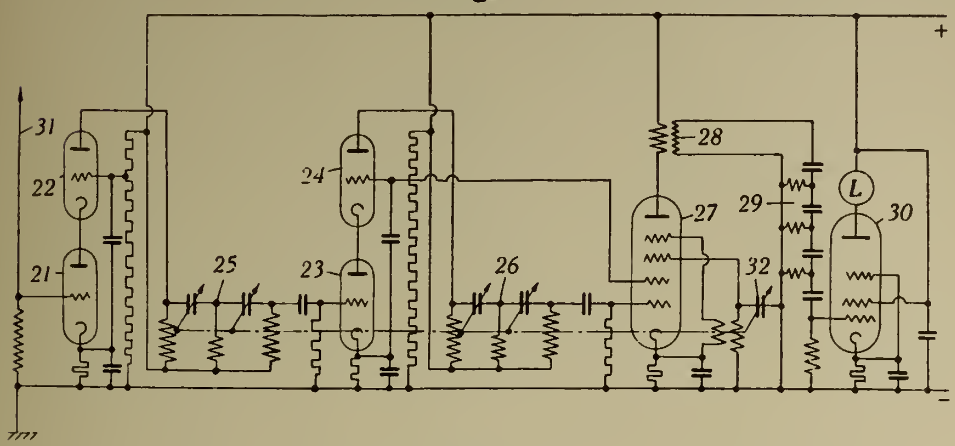


Fig. 9.

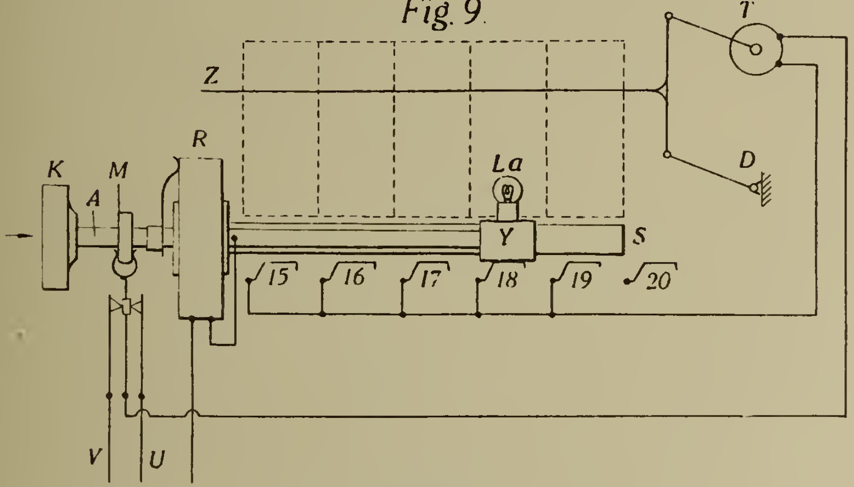
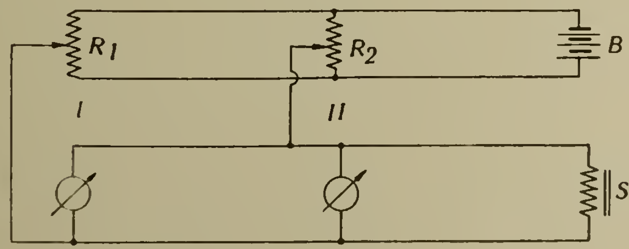


Fig. 10.



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Filed March 4, 1940

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Fig. 11.

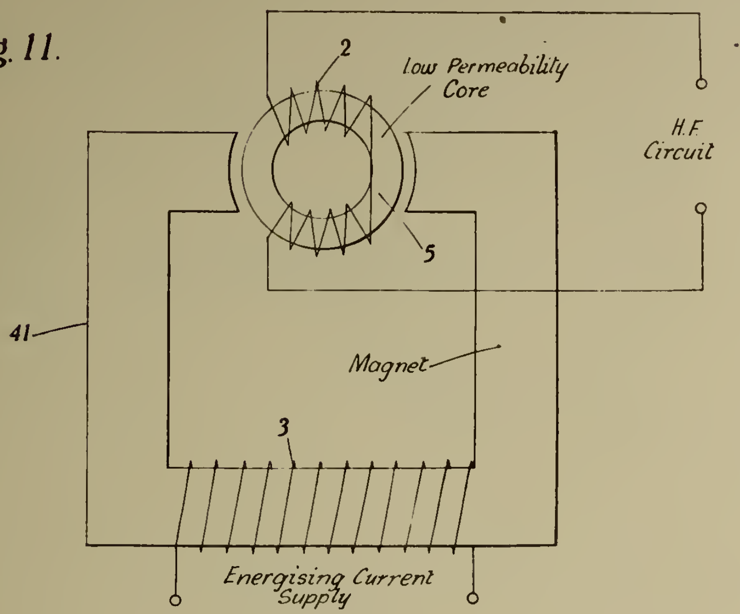

Fig. 12.

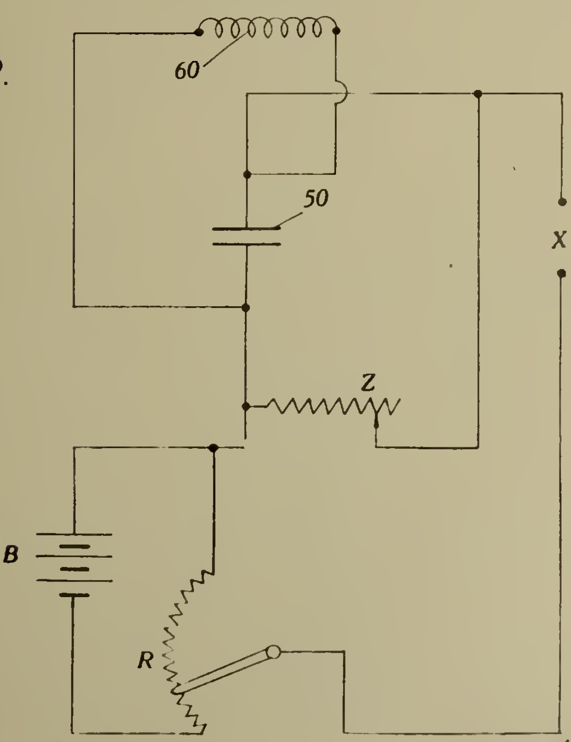

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Fig. 13.

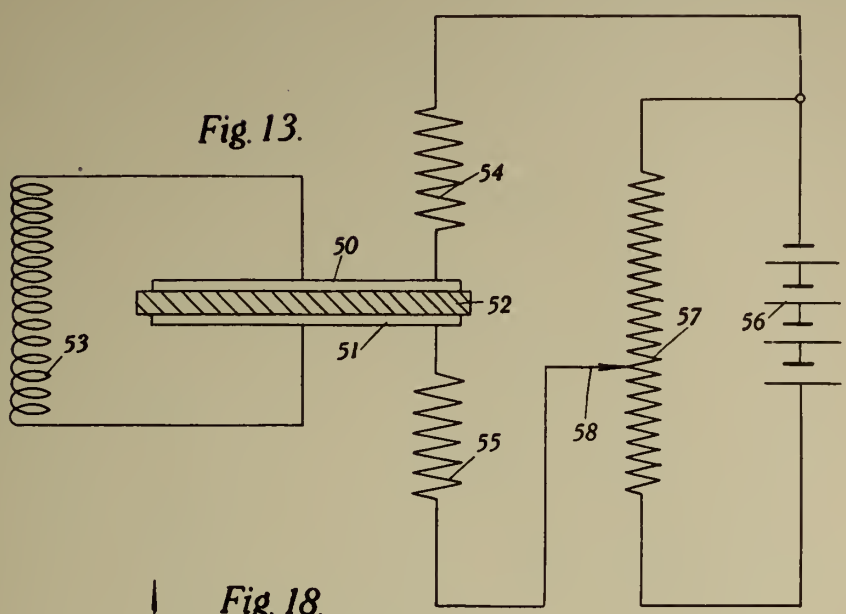

Fig. 18.

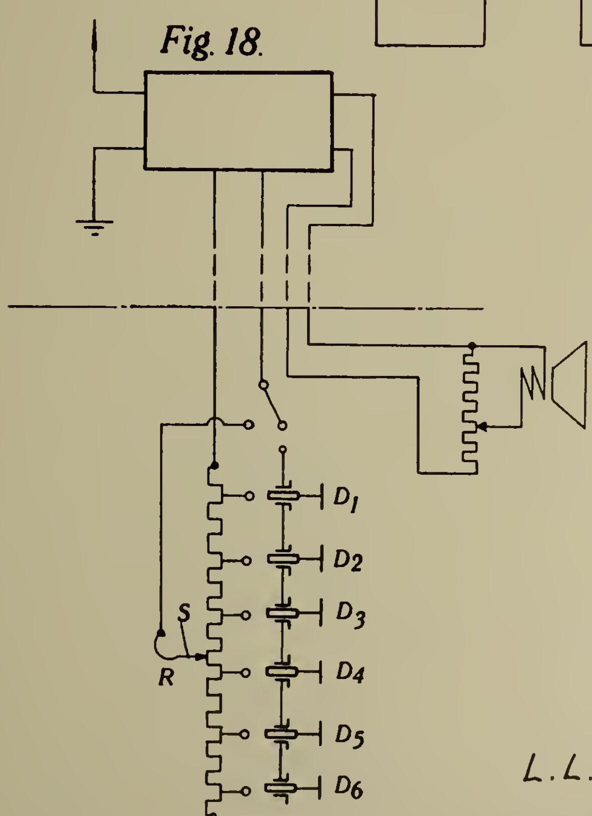

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Fig. 16.

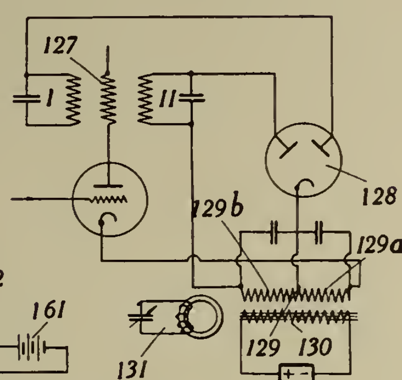

Fig. 14.

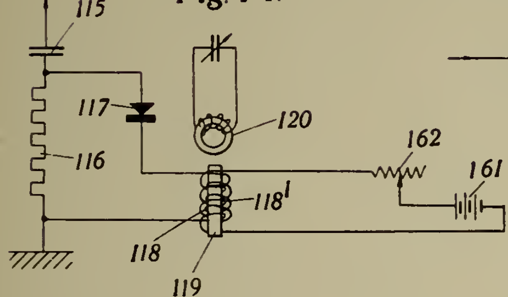

Fig. 17.

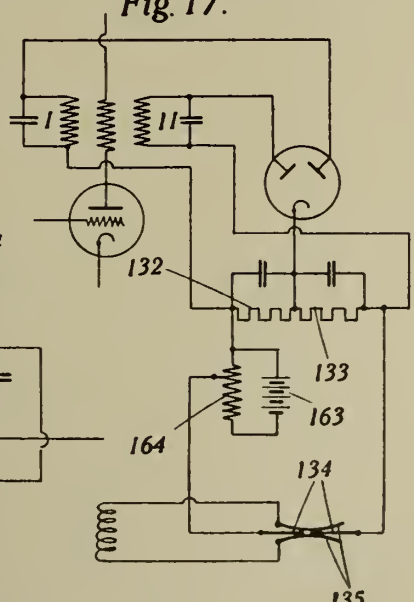

Fig. 15.

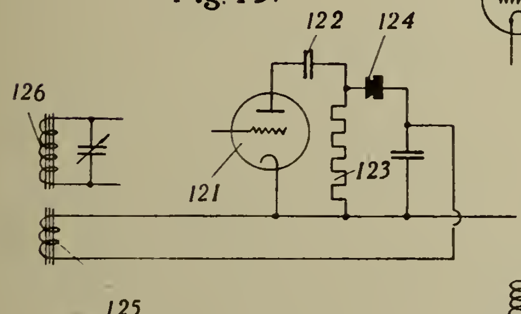

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Fig. 19.

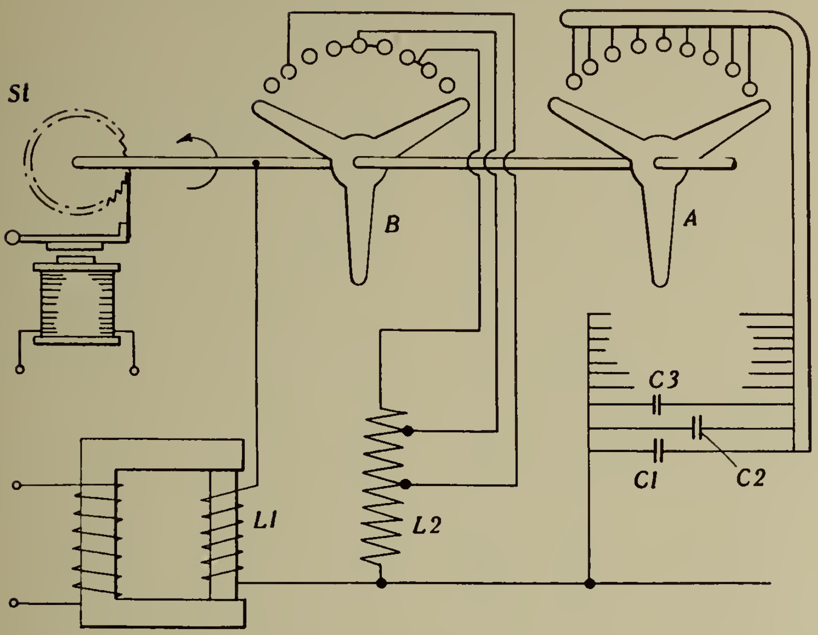
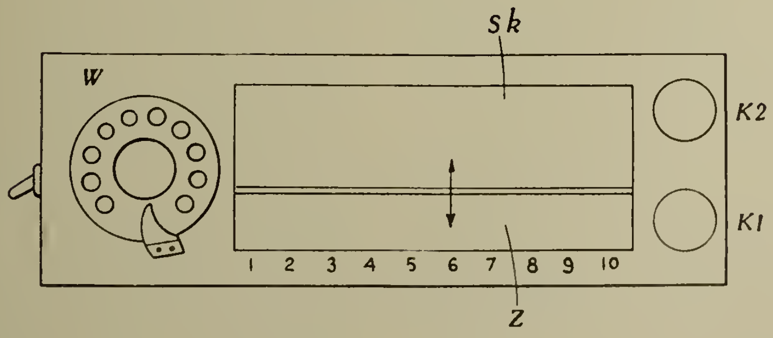


Fig. 20.



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ALIEN PROPERTY CUSTODIAN

DEVICE FOR ENVELOPING AND SEALING FLAT ARTICLES, FOR EXAMPLE LETTERS

August Reiner, Dresden, and Wilhelm Rehm, Berlin, Germany; vested in the Alien Property Custodian

Application filed March 4, 1940

Hitherto, letters and similar flat articles were enveloped by hand. For sealing letters, letter-sealing machines are known. But the known methods require the use of conventional ready envelopes, and the letters have to be folded and inserted in the envelopes by hand. By using conventional ready envelopes, the known methods are rendered more expensive, and inserting the letters in the envelopes by hand requires considerable time and is especially complicated.

With the device according to the invention, the enveloping of letters or similar flat articles is done by placing the letters between the loose parts of the envelope and connecting these parts at the edges so as to form the envelope and to enclose the letter. While conveying the letters to the loose parts of the envelope, the letters are conveniently folded in a suitable manner by doubling or knife-folding so as to have the desired size. According to the invention, the envelopes are formed of a top and a bottom leaf, which leaves are fed separately from rolls or sheets, and which are cut off and connected with each other after the letter has been inserted.

The device according to the invention makes it possible to provide the letters or similar articles in a simple and dry way with an envelope. The device can be worked completely automatically and at a rapid rate. Apart from the technical advantages, consisting in forming a seal which is safe against unauthorized opening, the device is economical and also affords a special advertising effect. The top and bottom leaves may consist of different colored papers or even of different materials, for example of transparent cellulose wrapping and paper.

The device for applying the method according to the invention materially consists of conveyor belts arranged in a machine frame and serving to convey the letters to be enclosed, as well as of rifling wheels for sealing the parts of the envelopes. Between the conveyor belts there may be arranged folding devices for automatically folding the letters to the desired size.

Further details of the subject of the invention will be described in conjunction with the accompanying drawing which is a diagrammatical illustration of an enveloping and sealing machine shown by way of example, and in which:—

Fig. 1 is a side view with the side wall removed,

Fig. 2 is a top view of the arrangement according to the invention, the paper being omitted for the sake of clearness of illustration,

Fig. 3 is a top view of a finished envelope.

Fig. 4 is a detail, and

Fig. 5 is a top view of a packet containing printed matter.

The conveyor belts 1 to 6 are arranged in a machine frame consisting of the side walls 50 and the base plate 51. These conveyor belts are driven by a motor 7 via driving belts 8 to 10. The letter to be enveloped is placed on the table 11 and is inserted between the conveyor belts 1 and 2, for example by the folding knife 12. On the table 11 there is a stop 13 arranged so as to have the fold at the desired place, for example in the first third of a letter sheet. The folding knife 12 is moved by rods 14 from a wheel 15 with a curved slot 16. For forming the second fold in the second third of the paper sheet, there is provided behind the conveyor belts 1 and 2 a folding knife 17, which is moved by rods 18 from a wheel 19 with a curved slot 20. The folding knife 17 inserts the folded letter between the conveyor belts 5, 6, by which it is moved to the enveloping and sealing device.

The paper 21, 22 serving to form the envelope is, for example, supplied from the rolls 23, 24, from which it is drawn through the rollers 25 and 26. At the ends of the rollers 25 and 26 there are rifling wheels 27 to 30. The conveyance of the letters and of the enveloping paper is regulated so that the letter is seized by the rollers 25, 26 when the enveloping paper 21, 22 has passed through the rollers 25, 26 in a width sufficient to form the seal. The rifling wheels 27 to 30 effect the connection of the top and bottom leaves at the lateral edges while the letter is conveyed and enveloped.

Behind the rollers 25, 26 there is a cutting device 31 operated by the wheel 15 and through a slot 32. The paper strips 21, 22 serving to form the envelope are detached, after the letter has passed through, so as to leave below the cutting edge a margin for forming the seal. The edges of the envelope, that are not yet connected, are now sealed by the rifling wheels 33 to 36. These rifling wheels 33 to 36 are attached to the rollers 37, 38 and are driven by the bevel wheels 39, 40 and 41, 42 respectively, running in opposite directions. At the same time, the rifling wheels 33 to 36 serve to deliver the ready enveloped letter. In order to facilitate the insertion of the enveloped letter between the rifling wheels 33 to 36, the latter are flattened at a part of their circumferences, as illustrated in Fig. 4.

On the rollers 25, 26 or 37, 38 there may be arranged a device 49 for printing the envelopes.

The printing may serve for advertising purposes, or it may give the address of the forwarder or of the addressee, or it may contain the impressed postage stamp. It is also possible to form the rifling wheels in known manner with profiles so that the sealed edge after the rifling will bear an advertising text, special signs, or a decoration.

The device according to the invention is suitable for enveloping folded as well as not folded letters, printed matters, or similar flat articles. The sealing of the envelope may either be made at all four edges by means of the rifling wheels as described, or some parts of the envelope may be left open (Fig. 4). It is also possible to use, instead of the rifling wheels, other sealing devices, for example wire-stitching or stamping machines for applying the method according to the invention.

For partly sealing the envelopes for printed matter, the toothing of the rifling wheels is, for example, provided with interruptions. Through the parts remaining open at these places of the envelope it is possible to inspect the contents without damaging the envelope (Fig. 4).

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FIG. 1.

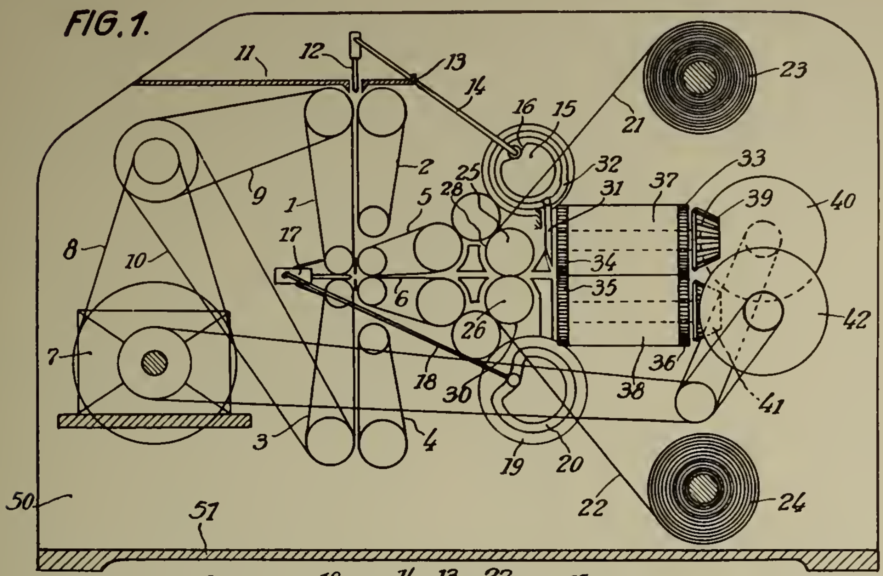


FIG. 2.

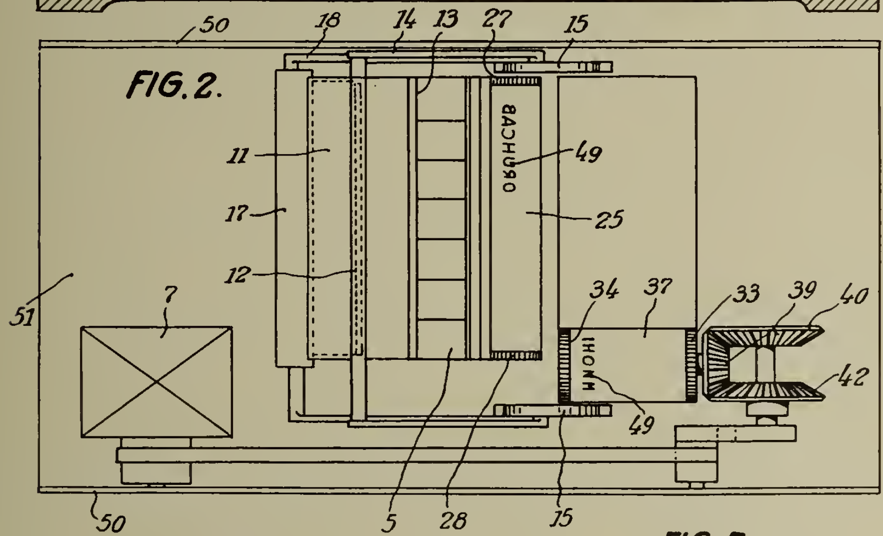


FIG. 3.

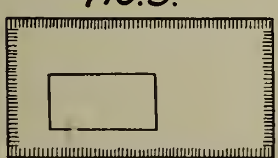


FIG. 4.

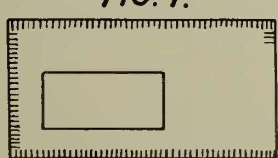
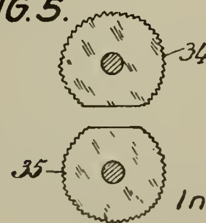


FIG. 5.



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ALIEN PROPERTY CUSTODIAN

METHOD OF AND MEANS FOR INSTRUCTING AND TRAINING STUDENT OPERATORS

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Application filed March 5, 1940

This invention relates to methods and means for instructing and training student operators so as to instill in the students knowledge and responsiveness for mainipulating the controls of a machine or process to effect desired conditions or operations, while at the same time offsetting any undesirable external forces and effects to which the machine or process may be subjected.

In controlling the condition or operation of various machines and processes, it is important that the operator become thoroughly familiarized with the operation of the controls before undertaking charge. This is particularly important in operating or piloting machinees, such as airplanes, where several controls must be manipulated in coordination to produce desired operations or maneuvers.

Referring further to airplanes, as by way of illustration, it is well known that airplanes are adapted to be maneuvered about three axes, the longitudinal, a transversely horizontal and the vertical. These movements may be affected by the pilot mainly through manipulation of the ailerons, the elevator and the rudder, respectively, the first two being controlled by a joystick which operates on a universal joint and the third by a rudder bar. In maneuvering the airplane the pilot must coordinate the movements of the stick and rudder bar to effect the desired maneuvers and at the same time maintain correct flight.

Devices have been heretofore constructed for preliminary ground training and testing of pilots, such as by providing a dummy cockpit supported by a kind of universal joint which enables the cockpit to assume different positions. The stability of the cockpit is usually influenced by external forces compelling the student to manipulate the controls so as to maintain the cockpit in a given position. This type of training device, however, depends on the student's feeling of equilibrium which, under some circumstances, is misleading. Other training devices heretofore proposed have been provided with instruments, but these do not teach the student how to manipulate the controls; they aid him in practicing after he has once learned the proper manipulation of the controls. Still other devices have proposed the use of a series of lamps, motion pictures, as in my French Patent No. 662,288, dated August 5, 1929, to simulate unbalanced flight which the student was supposed to correct by manipulating controls.

While these prior devices were intended to aid students in practicing control manipulation, none of them teach or show a beginner how to manipulate the controls, nor how to effect desired maneuvers.

It is therefore an object of my invention to provide improved methods and means to not only provide practice for a student but to also provide positive assistance to show students how to manipulate the controls in response to various conditions.

Another object of my invention is to provide methods and means for instructing and training student operators in various phases of training so as to instill in students a thorough knowledge of control manipulation and a responsiveness to act spontaneously in mainpulating the controls.

Another object of my invention is to provide a simple and relatively inexpensive means for instructing and training students in the art of manipulating the controls of a machine or process, as the case may be.

Additional objects and features of the invention comprise the provision of means for indicating to the student the proper manipulation of the controls; the provision of means for simulating actual operating conditions of a machine or process to which students may respond and thereby familiarize themselves with the feel and control of the machine or process as in actual practice; and the provision of means for indicating or recording the responsiveness of the student.

The foregoing object and others ancillary thereto are accomplished by my invention by simulating the operation of a machine or process by employing an object or a visual representation of an object which reacts or appears to react in accordance with the operation or condition of the controls or of the machine or process being controlled, or a representation or image of the machine or process itself or of instruments associated therewith. The controls or instruments may be represented by individual spots or images, such as arrows or the like, the positions of which indicate the positions of the controls or the readings of the instruments, as the case may be. Two or more movements or instrument readings may be combined in one image or spot, such as producing an apparent movement of the landscape in respect to an airplane maneuvering about its vertical, horizontal and longitudinal axes. Instead of the image of a landscape, a cross-lined grating may be used to produce a representation of rotation and movement in vertical and horizontal directions.

This representation may be accomplished in several ways, either mechanically or electrically, such as by using lamps and switches or by use

of a cathode ray tube or by optical means, to name but a few. Where optics are employed, the object representing the operations or conditions of the machine or process or of the instruments associated therewith which would be observable to the operator may be projected by means of one or more projection elements upon a screen in view of the student. One or more of the projection elements may be arranged for movement to simulate operations or conditions of the controls or of the machine or process.

The movement of the projection elements may be subject to variable external forces or to a determined series of effects or conditions. The student, in order to maintain the object stationary or in a predetermined condition, must operate his controls which are operatively associated with the projection elements to effect the desired movement of the projection elements as well as to offset or overcome the influence of external forces. The rate of movement or control of the projection elements, of course, may be varied depending on the stage of instruction for which the exercise is intended.

The electronic beams of the cathode ray tube having properties identical to light beams can be reflected, deflected and focused the same as light beams. It is therefore to be understood that what is stated in connection with optics and light beams also follows for the cathode ray tube and electronic beams, the apparatus associated with the cathode ray tube being varied in accordance with the characteristics thereof.

The apparatus may also be provided with means which may be used to impose a force upon the controls in response to the movement of the object away from normal position, thereby teaching and helping the student to make the proper manipulations. This feature of my invention may even be applied to the controls of the machine or process for automatic operation. Referring to airplane operation, the means responsive to movement of the machine or its instruments may be arranged to operate upon such elements as the rudder, ailerons, elevators, throttle, etc., to automatically maintain the plane in correct flight.

Images representing instruments associated with the machine or process may be projected upon the screen to indicate actual conditions thereof during a recorded or determined series of manipulations or operations. This may also be supplemented by the projection of objects such as spots upon the screen to represent the conditions or positions of the controls or the result of the operation of the controls.

The supplemental projections may also be utilized by means of photoelectric cells to impose forces upon the controls to teach the student the proper manipulation of the controls for particular maneuvers, or for stabilizing the machine when it is subjected to various disturbances. Projection elements may also be provided for controlling the projected images in response to manipulation of the controls so as to indicate the correctness and responsiveness of the student. The responsiveness of the student may also be checked by suitable metering means.

The projection devices may also be provided with sound recordings to explain the maneuvers projected or to furnish audible signals when the controls are not properly manipulated, or to simulate radio signals.

The above and other objects and features of the invention will become apparent upon considering the following description when taken in connection with the accompanying drawings, in which:

Fig. 1 is a diagrammatical view in plan of one form of apparatus having a plurality of projection elements which may be used to project a movable object upon a screen to simulate the movement of a machine, such as an airplane, or the landscape relative to the airplane or the indications of one or more instruments, or to give signals indicating control manipulations;

Fig. 2 is a view in vertical elevation of a deviating device which may be connected to one of the projection elements of Fig. 1;

Fig. 3 is a view of the left-hand side of the device shown in Fig. 2;

Fig. 4 is a schematic illustration of the connections between a manual control such as the usual rudder bar of an airplane and the electromagnetic coils of the device shown in Figs. 2 and 3;

Fig. 5 shows another form of deviating means operatively associated with a manual control, such as a joystick of an airplane;

Fig. 6 is a vertical sectional view taken along line 6—6 of Fig. 5;

Fig. 7 is a plan view of the deviating means illustrated in Fig. 5 showing a power drive for controlling the movement thereof;

Fig. 8 illustrates diagrammatically a further form of apparatus for projecting images upon a screen to simulate the function of various instruments and results of control operations;

Fig. 9 is a fragmentary view of a part of the apparatus shown in Fig. 8 at an enlarged scale;

Fig. 10 is a diagrammatical view of a screen showing the projection of images simulating instruments and the conditions of the controls;

Fig. 11 illustrates diagrammatically a device which acts directly upon the controls in response to movements of certain of the projected images; and

Fig. 12 is a diagrammatical illustration of the apparatus indicating the coactive relation of the elements and means for imposing forces upon the controls, in accordance with maneuver indications on the screen.

One form of apparatus by which the method of my invention may be practiced for instructing and training students to operate or pilot machines, such as airplanes, is diagrammatically illustrated in Figs. 1 to 4 of the drawings. The apparatus comprises a lantern 1 adapted to project a beam of light through a diapositive 2 containing an image, such as that of the landscape viewed from an airplane, against a mirror 3 mounted for movement about a vertical axis 3*a*. The mirror 3 is adapted to reflect the beam of light toward a mirror 4, which is pivotally mounted on an axis 4*a* transverse to the axis 3*a* for reflecting the beam of light through a suitable lens 5 and window 5*a* upon a screen 7. The diapositive 2 is adapted to be revolved in its plane by a suitable connection 2*a* while the mirrors 3 and 4 are adapted to be rotated back and forth about the axes 3*a* and 4*a*, respectively.

From the foregoing description it will be apparent that the position of the image or landscape on the screen 7 will depend upon the relative positioning of the projection elements 2, 3 and 4. Movement of the mirror 3 controls the horizontal movement of the projected image to simulate the movement of the airplane or preferably of the landscape relative to an airplane as when the rudder of the airplane is actuated, or the airplane is subjected to horizontal dis-

turbances. Movement of the mirror 4 about the axes 4*a* produces a movement of the projected landscape in a vertical direction, an effect normally produced by operation of the elevator of the airplane or by the forces of vertical disturbances. The rotation of the diapositive 2 effects a rotation of the projected landscape simulating the effect of airplane banking or rotation about its longitudinal axis. The image projected upon the screen may thus be caused to rotate and move in all directions upon the screen, depending upon the movements of the projection elements 2, 3 and 4.

In order to produce unpredictable movements for the projected image, the elements 2, 3 and 4 may each be operatively associated with a deviatable device having unstable equilibrium. This effect of the deviatable devices upon the projection elements may thus be advantageously utilized to produce unpredictable effects simulating an unbalanced machine which the student is required to correct. Controls characteristic of the machine may be provided to have an operative effect or control over the deviatable devices so that the student, by proper manipulation, can return the devices to their vertical or neutral positions. For example, the device which controls the movement of the diapositive 2 may be operatively associated with the joystick so that it can be influenced by operation of the stick similarly as would be the aileron of an airplane. The device controlling the mirror 4 would also be associated with the stick to simulate operation of the elevator of the airplane and the device controlling the mirror 3 would be associated with the rudder bar to simulate rudder control. Any suitable means, such as air movements from an oscillating fan or other means may be provided to cause the devices to move from neutral position, whereupon further movement will be caused by action of gravity or by power controlled means.

Referring to Figs. 2 and 3, a form of deviating device is shown comprising a rod-shaped member 6 which is provided with a shaft 7 disposed transversely thereof and supported in suitable bearings 8 and 9. The shaft 7 is provided with a bevel gear 10 which is adapted to mesh with a bevel gear 11 operatively connected to the mirror 3. The rod 6 may be threaded at both ends for receiving weights 12 and 13 by which the center of gravity may be adjusted relative to the axis of the shaft 7. The rod 6, to represent correct operating condition, should be in a vertical position. In order to return or maintain the rod 6 in a vertical position, the rod is shown provided with a pair of oppositely disposed arcuately shaped arms 14 and 15. These arms are associated with solenoids 16 and 17, which when properly energized are adapted to magnetically urge the rod toward vertical position. The energization of the solenoids 16 and 17 is in turn controlled by a manual control which in the case of the mirror 3 would be the rudder bar.

The connections for the solenoids 16 and 17 are shown in Fig. 4 connected to a rudder bar 20, whereby the deviatable rod 6 is adapted to be returned toward vertical position upon proper manipulation of the bar. The bar 20 is provided with electrical brush contacts 18 and 19 at the extremities thereof for brushing engagement with an arcuately shaped stationary contact 19*a*. The circuits thus completed are adapted to energize one or the other of the solenoids 16 and 17, depending on the operation of the rudder bar 20. Should the rod 6 move out of vertical position the student may by operating the rudder bar 20, energize either of the solenoids 16 or 17 to effect the return of the rod to vertical position. Since the movement of the rod 6 changes the position of the mirror 3 and therefore the position of the image projected upon the screen, the student may, by proper manipulation of the rudder bar, return and maintain the rod 6 in vertical position, thereby stabilizing this component of the control over the projected image.

The operation of the apparatus thus described produces effects simulating airplane flying conditions, it being understood that the joystick is associated with two deviatable devices, one connected to the diapositive 2 and the other to the mirror 4. Thus the student observing the image on the screen must act, whenever the image starts to rotate or move out of a state of equilibrium, by manipulating the stick and rudder bar to effect the return of the image to a normal determined condition. Practice with this form of the invention enables students to improve their responsiveness to operate the controls. In the case of beginners, however, it is desirable to provide means to indicate the proper manipulation by imposing forces on the controls, in response to movements of the projected image.

Referring to Figs. 2, 3 and 4, the rod 6 is shown provided with a sector 24 having electrical contacts 25 and 26 which are adapted to engage a stationary brush 27 as the rod deviates to the left or right from the vertical position, as viewed in Fig. 2. The rudder bar is provided with two arcuate arms 20*a* and 20*b* operatively associated with solenoids 21 and 22, respectively. The solenoids 21 and 22 are connected to a lead 28 of a source of electric power through a rheostat R, while the brush 27 is connected to the opposite lead 29. By this arrangement the bar 20 is adapted to be subjected to an electromagnetic force in the direction the control should be moved. The force thus applied is of the nature of a dual flight instruction. The force, however, may be varied by the rheostat R so as to be suggestive only or of sufficient strength to produce automatic control operation.

The application of a force opposite to the proper control movement, such as sometimes experienced in actual flight, may be obtained by interchanging the electrical connections. This opposing force gives the student the feel of resistance to control manipulation which is desirable after the student has learned the fundamentals of control manipulations.

Bearing in mind that the diapositive 2 and each of the mirrors 3 and 4 are more or less similarly controlled by deviatable devices, such as the rod 6, the operation of the apparatus may be outlined as follows. With the student sitting in a cockpit before the screen 7, a projected image of the landscape may be caused to simulate a landscape such as viewed from an unbalanced airplane. The unpredictable movement of the deviatable devices, however, operates through brushes 27 and the associated contacts to impose force upon the controls in directions to maintain stable flight, thereby teaching the beginner the proper control manipulations for overcoming various disturbances. As the beginner learns the proper method of control manipulation, the strength of the imposed forces may be decreased and even reversed so as to better simulate the action of the controls as in solo flight.

In order to check the responsiveness of a student, a suitable metering device M may be associated with each deviatable device, such as illustrated in Fig. 3, so as to record the time each device is permitted to remain beyond a given deviation, thereby furnishing the trainer a record of the precision and rapidity of the student's reactions.

Where it is desirable to control the rate of movement of the deviatable devices, power means may be provided. By utilizing power control, the movement of the deviatable devices may be operated slowly. It is also possible to vary the speed of movement of the deviatable devices in proportion to the degree of movement of the controls, thereby giving more nearly the same effect as experienced in actual flight.

This feature is shown in Figs. 5 to 7 associated with a joystick **30**. The stick **30** is diagrammatically illustrated for operation with a universal connection at **31** whereby control of the ailerons and elevator may be effected. For brevity, only the connecting mechanism to the shaft **33** will be described, the principle of operation being the same for both the aileron and the elevator and also for the rudder bar.

The shaft **33** is mounted in suitable bearings **34** and carries a sector **35** which is provided with two segmental contacts **36** and **37**, which may be adjustable, if desired. Rotatably mounted on the shaft **33** is a gear **38** integral with a lever **40**. The lever **40** is provided with a brush **41** which is adapted to engage the segmental contacts **36** and **37** to complete certain controlling circuits, depending upon the relative positions of the stick and the deviatable device **6***a*. The device **6***a* is provided with a gear **43** which may be directly in mesh with the gear teeth **38** or spaced apart and operatively connected by other means, such as an endless chain **42**. To control the movement of the deviatable device **6***a* a pair of spaced, oppositely opposed bevel gears **44** and **45** are operatively connected to the shaft **7***a*. A bevel gear **46** driven by a motor **48** is adapted to be shifted to engage one or the other of the gears **44**, **45**, depending on the direction in which the device **6***a* moves from vertical or neutral position. The drive between the motor **48** and the bevel gear **46** comprises reduction gearing **48***a*, a flexible shaft **49**, a rigid shaft **50** and a sleeve **52**. The sleeve, which is pivoted at **54**, rotatably supports the shaft **50**. The bevel gear **46** is maintained in a neutral position between the bevel gears **44** and **45** by oppositely opposed springs **55** and **56** attached to the sleeve **52**. The sleeve **52** is also provided with a pair of iron cores **57**, **58**, which are operatively associated with solenoids **60** and **61**, electrically connected to the contacts **36** and **37** respectively, similarly as illustrated in connection with deviatable device **6** in Figs. 2, 3 and 4.

The motor **48** may be continuously energized to provide a continuous rotation of the gear **46**. When the device **6***a* is caused to move out of vertical position, the brush **41** is brought into engagement with one of the segments **36** or **37**, thereby closing a circuit to one or the other of the solenoids **60** and **61**, depending on the direction of movement of the device **6***a*. As soon as one of a solenoid **60** or **61** is energized, the gear **46** is moved to engage one or the other of the gears **44** or **45** to thereby control the further movement of the device in its movement away from vertical position. Thus, as soon as the device leaves vertical position, it is brought under control of the gear **46** and caused to move in accordance with the speed of the motor **48**. The movement of the deviatable device being under control of the motor **48**, the movement thereof may be arranged to be very slow, and if desired to accelerate in speed the further it is permitted to move from vertical position. This latter effect may be accomplished by providing the lever **40** with an additional brush **64** for engagement with a series of rheostat contacts **65** carried on the sector **35**. The rheostat contacts **65** are diagrammatically illustrated in Fig. 7, indicating that the electric power to the motor **48** is increased as the brush is moved relative to the left or right of the center **66** of the rheostat **65**.

In operation, should the device **6***a* be caused to deviate from vertical position, the lever **40** would be moved proportionally completing a solenoid circuit by brush engagement with either contact **36** or **37**, as the case may be. This causes the gear **46** to engage the proper gear **44** or **45** to continue the movement of the device **6***a* under power of the motor **48**. The movement of the brush **64** in passing over the rheostat contacts **65** controls the current to the motor so as to accelerate the movement thereof the further the brush **65** moves relative to the rheostat center **66**. To return the device **6***a* to vertical position and thereby maintain the projected image in proper position on the screen, the stick **30** must be moved sufficiently to effect a reversal of the driving engaging of the gear **46**. Should this corrective movement of the stick be exaggerated, the brush **64** will be moved beyond the rheostat center **66** to accelerate the return movement of the device **6***a* similarly as in the case of over actuation of the controls of an airplane. As the device **6***a* approaches vertical position, the stick **30** must be actuated to slow the correcting movement or the device will move beyond vertical position just as in airplane maneuvering. The affect of the stick operation on the deviatable device is conveyed to the student by his perception of the projected image of the landscape or other object, such as viewed by the aviator in actual flight, as well as forces, such as disclosed in connection with the forms illustrated in Figs. 2 to 4.

Another embodiment of the invention is illustrated in Figs. 8 to 12, which is particularly suitable for instruction in complicated maneuvers. For example, students may, by use of this form of the invention, be instructed and familiarized with particular maneuvers or series of maneuvers, or even with the characteristics of a particular machine or process.

Briefly, recordings of the instrument readings and operations of the controls of a machine or process may first be recorded either in an actual operation, by operation of a dummy machine or by artificial production, and in the case of aviation, the recording may be of the instruments during a particular flight.

These recordings may be utilized so as to project the same readings and indications upon a screen before a student. The projections may comprise the particular instrument or an image of the instrument needle or a spot indicating instrument movements. The projections may also include spots or images indicating control operations or readings of instruments responding to one or more components of machine movement or condition. These latter spots would be, in substance, a duplication of instrument readings, except that as in the case of aviation the spots indicating airplane movements may be used to

teach beginners the action of the instruments during various maneuvers. These projected spots may also be utilized by means of photoelectric cells to teach the student the proper control manipulation or feeling of control reaction by imposing forces on the controls similarly as in the form of Figs. 1 to 4, and later, as a means of checking the accuracy of the student in control manipulation in response to instrument readings only. The recording may also be provided with sound effects, radio signals, or verbal instructions.

Referring to Figs. 8 and 9, the variable factors pertaining to instrument readings, etc., are first recorded on a film **85**, preferably an opaque film with recordings in the form of translucent lines. The film having the recordings is adapted to be moved past a series of lanterns **86**, **87**, **88** and **89**, the film being transposed by means of rollers **90** for double passage at right angles across the lantern **88**. The recording of variables representing readings of various instruments as well as indications of control performances are indicated on the film **85** (Fig. 9) in the form of wavy lines. These translucent lines permit the passage of a beam of light for projection upon a screen. The beam of light may be controlled by a suitably shaped opening so as to project the many conditions of the recorded line as a movable spot or instrument needle. As shown in Fig. 9, a shutter **92** is provided with a narrow window **93** across which four translucent lines *a*, *b*, *c*, and *d* are adapted to pass. Each translucent line is adapted to provide for the projection of a spot upon the screen **100** representing the reading of an instrument, such as a tachometer, speedometer, turn indicator and bank indicator. Other instrument readings may also be added. The screen may be marked substantially as indicated in Fig. 10 to represent the graduation of these instruments or a separate lantern **94** may be provided to project such indications. The spots depending on the waving characteristics of the lines *a*, *b*, *c* and *d* will be caused to move back and forth relative to the graduations of the indicated instruments. The three recorded lines *e*, *f* and *g* may represent variables corresponding to operation of the elevator, the rudder and the ailerons, respectively. The recording *h*, with which the lantern **89** is adapted to cooperate, may be a sound recording to provide verbal instructions as the exercise proceeds or to give sound effects ordinarily accompanying the particular maneuver, or they may comprise radio guide signals, if desired.

While the lanterns **86** to **89** are spaced apart, the different curves are so provided as to be projected by the lanterns in synchronism. The lantern **87** is provided with a window **95** to permit the projection of the characteristics of the line *g* in a linear dimension. Where desired, the window of a lantern may be moved to correspond with one of the variables, thereby providing a projection, the movement of which is bidimensional, each dimension corresponding to one variable. This may also be effected by intersecting two of the wavy lines representing two variables before a lantern, such as the lantern **88** (Fig. 8).

The screen **100** may be provided with a marking or the projection of a circle or other mark **97** which will, when the projected spot G coincides therewith, represent that the control is in proper position. Should the line *g* vary, the lamp **87** would then project the variations of the spot G in a linear dimension horizontally of the screen and relative to the circle **97**. The movement of the spot G indicates to the student the movement expected of his control, the ailerons in this instance, which may be returned to the circle **97** by proper manipulation of the joystick. The control of the projection may be provided with the provision of one or more mirrors, such as indicated in Figs. 1 and 12, suitably interposed somewhere between the source of lantern light and the screen, one of the mirrors being connected for operation in response to movement of the aileron control to offset variations in the projection of the spot G. Thus, as the spot G varies to the right or left of the circle **97**, it would indicate that the aileron control is not in proper position. Since this effect is deducible from the instrument readings, it will be understood, as hereinafter described, that the projections of the controls may be hidden from the student's view for advanced training.

The lines *e* and *f* are combined by intersecting the lines at right angles before the lantern **88**. This produces a single spot EF, which may move in any direction from the circle **101** for movement in the area **102**, which is divided into quadrants by the intersection of the lines **105** and **106**. The control of the spot EF may be accomplished by providing two mirrors, such as **103** and **104** of Fig. 12, between the lantern **88** and the screen **100**. Thus the student will be able by properly manipulating his controls to return or maintain the spot EF in the circle **101**.

The controls of the student may be arranged to receive automatic forces in response to movements of the spots EF and G. A form of means for providing the automatic control actuating forces is diagrammatically illustrated in Figs. 11 and 12. Two cameras **107** and **108** are provided with lenses **109** and **110** focused upon the area **102** of the screen **100** over which the spot EF is adapted to move. The cameras **107** and **108** are each provided with a ground glass **111** and **112** and a partition **113** and **114**, respectively, dividing the cameras into compartments to house a pair of photoelectric cells **115**, **116** and **117**, **118**, respectively. Referring to the camera **108**, each cell thereof views one-half of the screen, as determined by the line **105**. The camera **107** being disposed at 90° with respect to the position of the camera **108**, the cells thereof each views a half of the screen, as determined by the line **106**.

Referring to Fig. 12, any movement of the spot EF to the left or right of the line **105** will be viewed by one or the other of the photoelectric cells of the camera **108**. Likewise, any movement of the spot above or below the line **106** will be viewed by one or the other of the cells of the camera **107**. The cells **115**, **116**, **117** and **118** of the cameras **107** and **108** are electromagnetically connected to controls, such as the rudder bar **120** and joystick **126** by suitable relays **121**, **122**, **123**, and **124**, and solenoids **127**, **128**, **129** and **130**, respectively. As illustrated in Fig. 12, the rudder bar **120** is associated with the solenoids **129** and **130** and operatively connected by suitable means to the mirror **103**. The elevator control **125** of the stick **126** is associated with the solenoids **127** and **128** and operatively connected by suitable means to the mirror **104**. The projection lantern **88** may be arranged to project the recording of the lines *e* and *f* upon the screen area **102** under control of the mirrors **103** and **104**.

In operation of the apparatus, the recordings projected by the lantern **88** are viewed by the

mirrors of the cameras 107 and 108 to automatically actuate the controls 120 and 126 and thereby return the spot EF to the circle 101 each time it is caused by the recordings to vary therefrom. Assuming that the spot EF is moved by the lantern 88 from the circle 101 upwardly along the line 105, the spot will be viewed by the cell 116. The cells of the camera 108 will not view the spot as long as it remains on the line 105 since the focus thereof falls in alignment with the partition 114. The cell 116 when activated by the spot EF energizes the solenoid 128 to impose a force upon the stick 126 in the proper direction to cause the mirror 104 to effect the return of the spot EF toward the circle 101. Should the spot EF be moved into the upper left-hand quadrant of the area 102, as shown in Fig. 12, the cells 116 and 118 will both view the spot to energize the solenoids 128 and 130 to so maneuver the controls and the mirrors associated therewith to return the spot to the circle 101. It will thus be apparent that for any movement of the spot EF from the circle 101, it will be viewed by certain of the photoelectric cells to impose forces upon the proper controls to effect the return of the spot to the circle. If desired, the circuits may be arranged so that the forces tend to act in directions opposite to that described above. Rheostats may also be included in the circuits to vary the intensity of the forces. The projection of the spots EF and G can also be removed from view of the student during advanced instruction, and if desired, caused to act upon metering devices. It should also be recognized that the instrument readings may continue to increase or decrease or remain the same after actuation of a control or the return of a control to normal position. These relationships between the instruments and controls may easily be perceived by the student by use of the spots EF and G. While the spots associated with the instruments indicated on the screen 100 are not normally affected by operation of the controls, suitable mirrors may be provided for such control, if desired.

Means similar to the cells 115 to 118 may be provided to view the spot G for automatically imposing force upon the aileron connection of the stick 126 for the purpose of instructing the student in the manipulation of the stick for aileron control.

Devices similar to the cells 115 to 118 may be provided for response to spots other than the spots recording the position of the controls. That is, they may be arranged, for instance, for response to the projection of spots which record the forces acting upon the controls, so as to function in coordination with the main projections. A still further use of the apparatus may be effected by the use of a lantern located in respect to the mirrors 103 and 104 similar to the lantern 88 but on the order of the lantern 1 in Fig. 1. The beam of light from such a lantern being controlled by the rudder bar and the stick may be caused, by manipulation of the rudder bar and stick, to follow and coincide with the spot EF projected on the same screen by the lantern 88. A student may thus practice the maneuvers by causing the controlled beam to follow the spot projected from a recorded operation by the lantern 88. This recording may be that of a particular flight or of maneuvers carried out by a particular airplane. Since airplanes have distinct characteristics, it will be apparent that such use of the apparatus of my invention may also be utilized in the ground training of students for the purpose of flying a particular airplane.

The apparatus diagrammatically illustrated in Fig. 12 is also contemplated for use with unpredictable deviating devices, such as shown in Figs. 2 to 7. That is, the lantern 88 and the mirrors 103 and 104 may be provided in association with deviatable devices for unpredictable movement which the cameras 107 and 108 may observe and relay to the student for instruction in control manipulation.

While my invention has been illustrated and described in connection with the training of airplane pilots, it should be recognized that it is readily adaptable for use in the training of operators for process as well as machines other than airplanes. It will also be readily apparent to those skilled in the art that many changes may be made in the construction, arrangement and use of the embodiments illustrated and described. For example, a cockpit for the student may be supported for movement about its longitudinal, horizontal and vertical axes, and the responsiveness of the photoelectric cells of the cameras 107 and 108 used to effect a movement of the cockpit similar to an airplane in actual flight. The cockpit thus supported may also be connected for operation in response to several unpredictable variating devices, such as those illustrated in Figs. 2 to 8, the student being required to right same by manipulation of the controls. The projection may also be performed by cinematographic method. It should also be apparent that two variating devices may be associated with a single mirror giving it the summation of two influences instead of a single influence. For these reasons it is to be understood that the forms of the invention herein illustrated and described are to be regarded as illustrative of the invention only and not as limiting the scope of the appended claims.

WSEVOLODE GRUNBERG.

PUBLISHED

JUNE 1, 1943.

BY A. P. C.

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METHOD OF AND MEANS FOR INSTRUCTING AND TRAINING STUDENT OPERATORS

Filed March 5, 1940

Serial No. 322,289

4 Sheets–Sheet 1

Fig. 1.

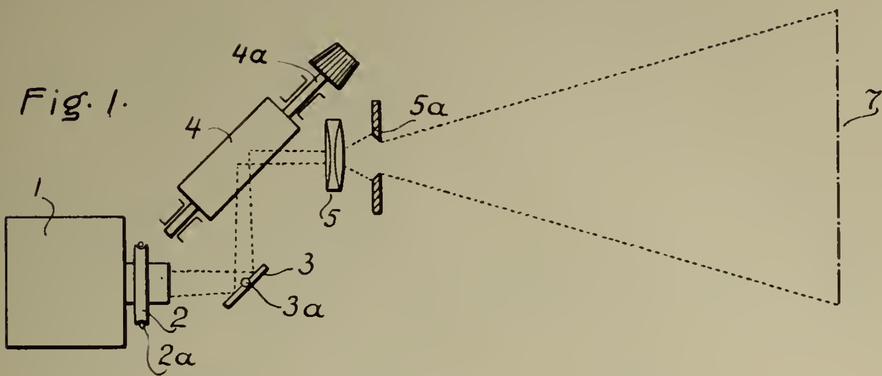
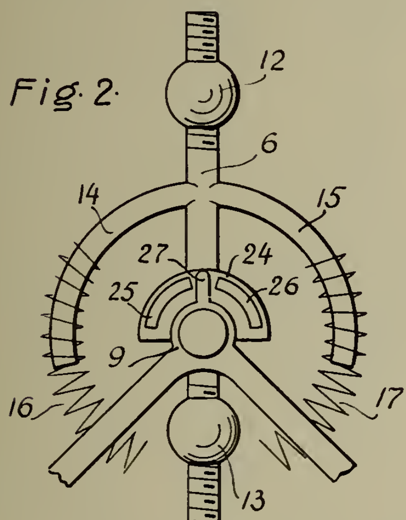


Fig. 2.



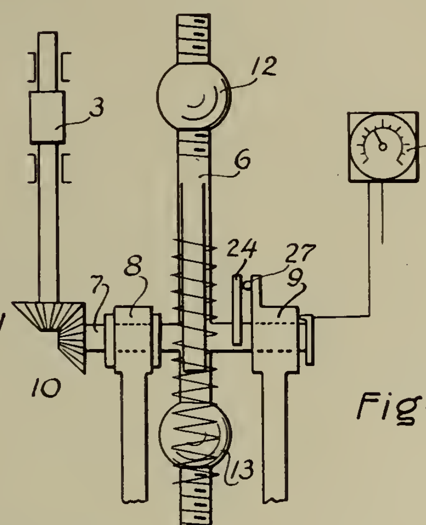
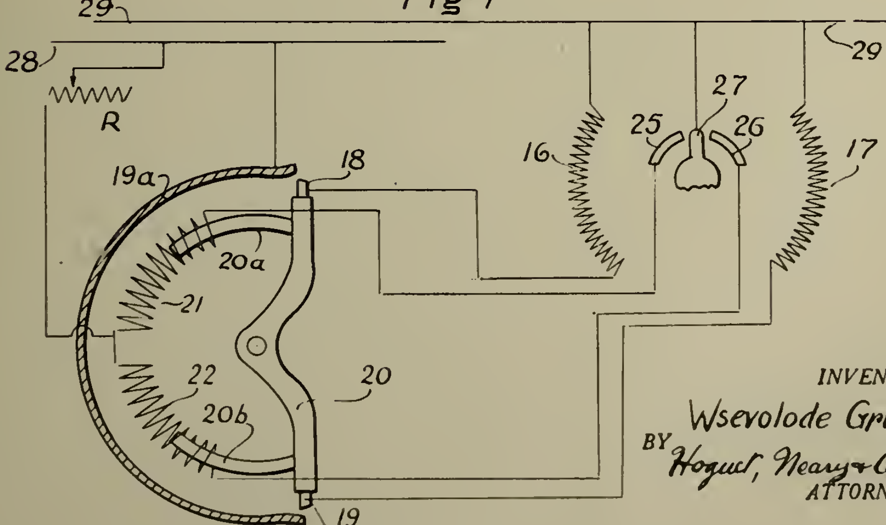


Fig. 3.

Fig. 4.



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4 Sheets-Sheet 2

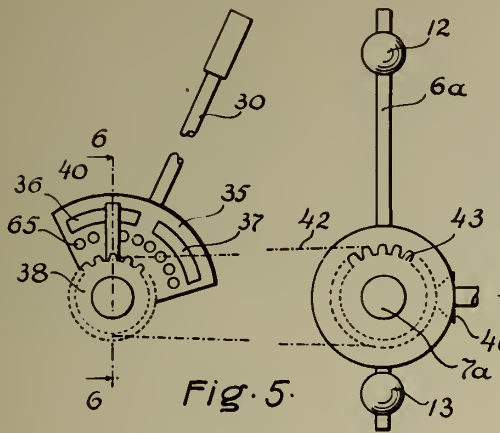

Fig. 5.

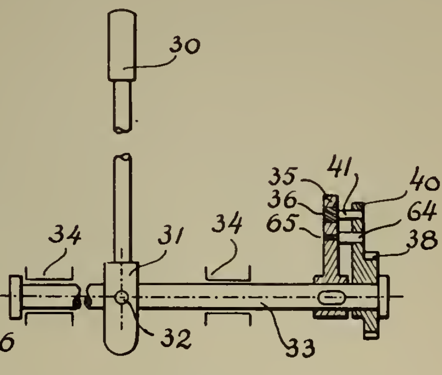

Fig. 6.

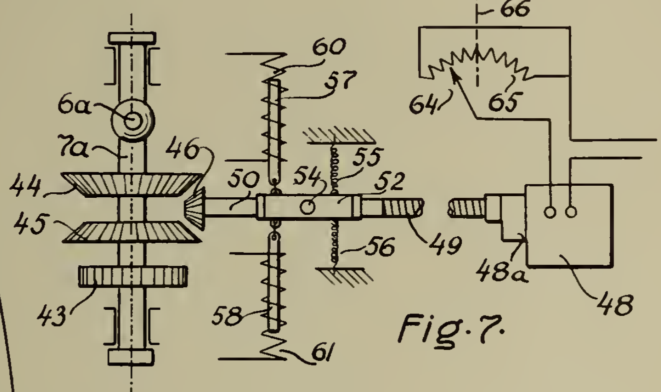

Fig. 7.

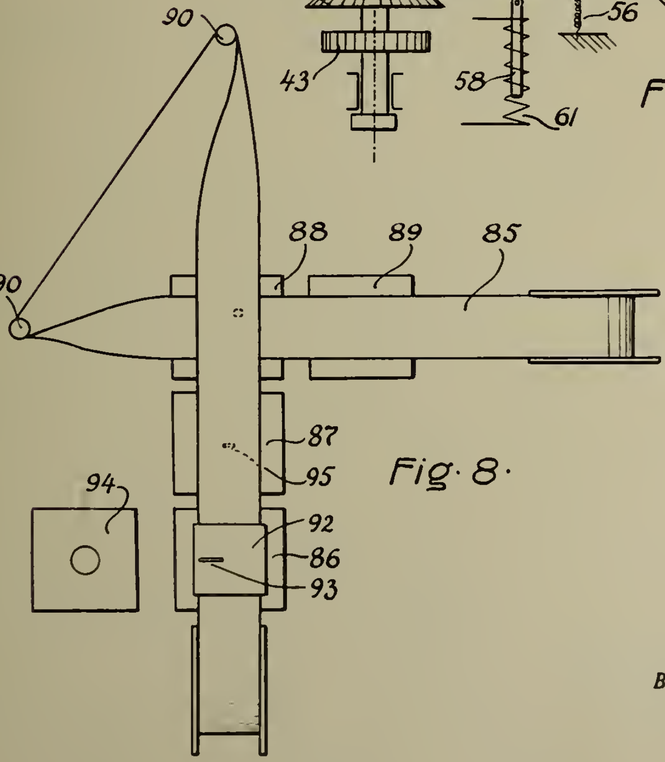

Fig. 8.

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322,289
4 Sheets-Sheet 3

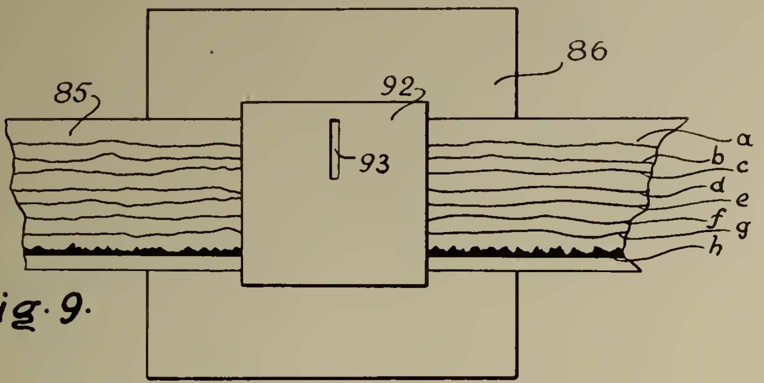

Fig. 9.

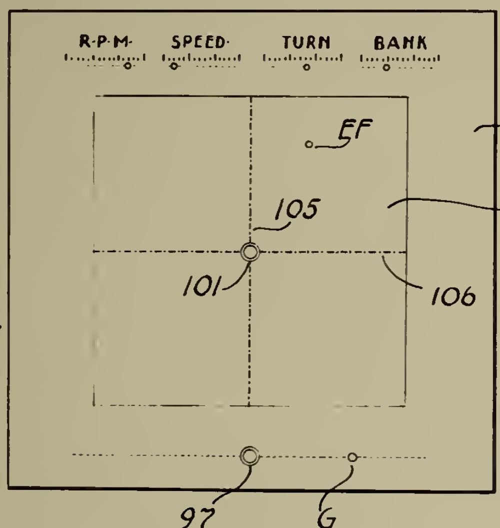

Fig. 10.

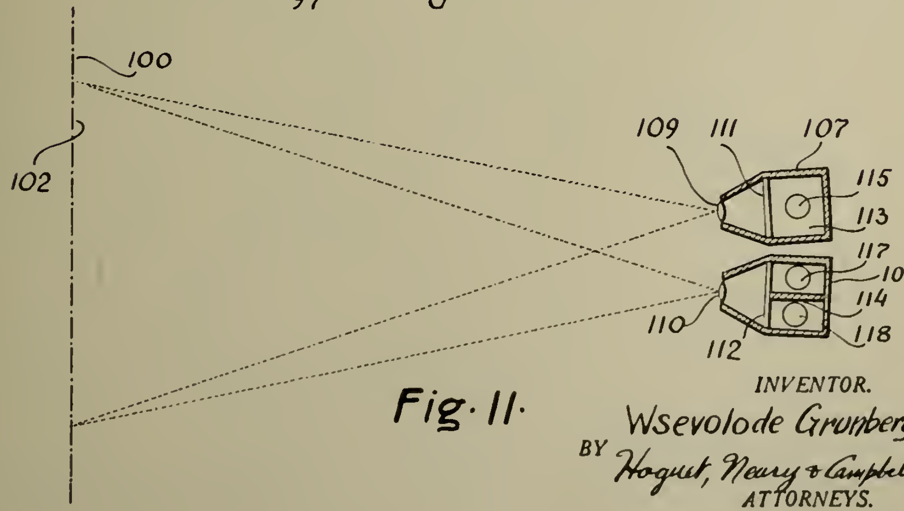

Fig. 11.

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4 Sheets-Sheet 4

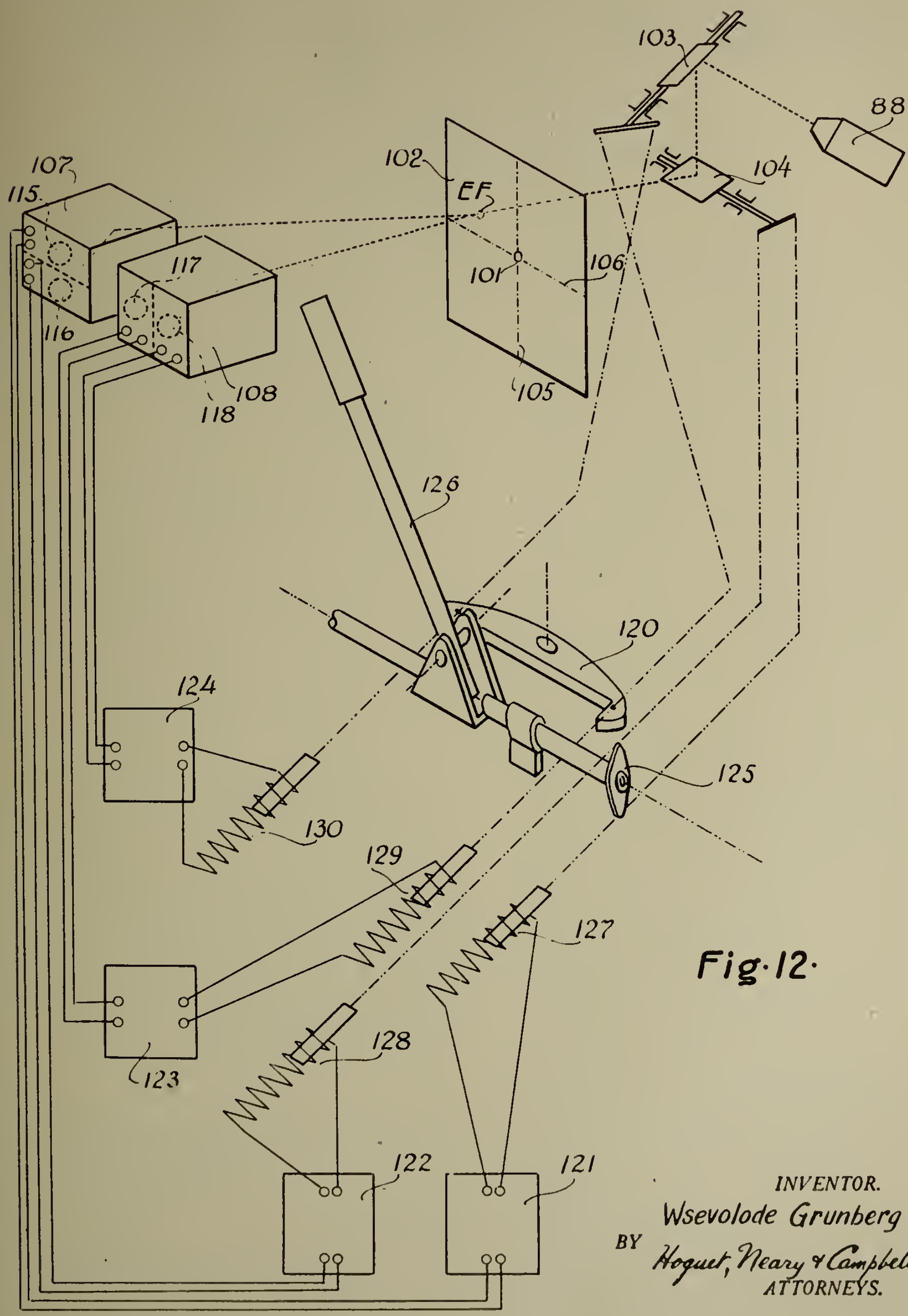

Fig. 12.

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Published June 1, 1943 Serial No. 322,387

ALIEN PROPERTY CUSTODIAN

IGNITION DEVICE FOR INTERNAL COMBUSTION ENGINES

Franz Dausinger, Stuttgart, Germany; vested in the Alien Property Custodian

Application filed March 5, 1940

This invention relates to electric ignition devices for internal combustion engines comprising a gas discharge tube acting as a control valve.

Ignition devices for internal combustion engines usually comprise mechanically operated switching devices for controlling the firing or ignition point in the cylinders of the engine. In order to avoid the disturbances produced by wear of the mechanical contacts, it has been suggested already to replace the mechanical switching devices by electrical means, i. e., by gas discharge tubes acting as control valves. In practice, however, it was found difficult to carry out this proposal, because neither the ignition voltages of various tubes of the same type nor the voltages of the sources of current used for the supply of ignition devices for internal combustion engines are sufficiently constant. It has been attempted to avoid this drawback, at least with tubes comprising control grids, by the provision of a grid bias which changes in the ignition point, but in this case, mechanically operated switching means were again required for connecting the control voltage to the grid and for disconnecting it therefrom. Such switch means, of course, are electrically relieved, since they do not carry the working current, but still they show the inherent defects of any mechanically operated switch.

It is an object of the invention to provide means for eliminating this defect of the known ignition devices comprising gas-discharge tubes.

With this and further objects in view, as may become apparent from the within disclosures, the invention consists not only in the structures herein pointed out and illustrated by the drawings, but includes further structures coming within the scope of what hereinafter may be claimed.

The character of the invention, however, may be best understood by reference to certain of its structural forms, as illustrated by the accompanying drawings in which:—

Fig. 1 is a circuit diagram of a four-cylinder internal combustion engine having the invention applied thereto.

Fig. 2 is a diagram showing the voltage conditions in the ignition device and

Fig. 3 is a diagrammatic view of an impulse generator for use in connection with the invention.

The invention contemplates the provision in the tube circuit of an impulse generator which produces a voltage impulse for igniting the gas discharge tube in the firing point. This impulse generator may be interpolated in the plate circuit where a gas discharge tube is used having two electrodes only, or in the grid circuit of a grid-controlled gas discharge tube.

Referring now to the drawings in greater detail, and first to Fig. 1, it will be seen that one pole of a source of alternating current *a* is connected to the anode *c* of a gas discharge tube *e*, through the primary *b* of an ignition coil *b*, *i*, while the other pole is connected to the cathode *d* thereof. The grid *f* of the tube *e* is negatively biassed by the voltage of a storage battery *g* to block the tube against the passage of current from the source *a*. Moreover, an alternating current generator *h* is interconnected in the grid circuit which generates voltage impulses having a very steep wave front, at a frequency corresponding to the ignition frequency, said impulses being superposed to the negative grid bias. With each voltage impulses E_h generated by the impulse generator *h* the bias E_g is reduced to an amount which is lower than the critical grid voltage E indicated by the hatched surface and varies with the working conditions, so that the tube *e* is not blocked any more by the grid bias. The anode voltage E_c is thereby reduced to the burning voltage of the tube, (which is the characteristic voltage of the ionised gas path) whereby an anode current and a current through the primary *b* of the ignition coil *b*, *i*, is caused which in turn induce a voltage in the secondary *i* of the ignition coil applied to the spark plugs *l*, through a distributor *k*. As a result, an ignition spark jumps over at the spark plugs *l*. After the current has passed through zero, the tube is blocked again by its bias.

It will be understood that in place of the direct current voltage derived from the storage battery *g*, for example, an alternating current voltage having a certain phase displacement with respect to the voltage of the source of alternating current *a* and having an impulse voltage superimposed to it may be applied to the grid *g* of the tube *e*.

While any suitable impulse generator may be used on principle to produce the voltage impulse E_h which are superimposed to the grid bias, I have shown a particularly suitable and simple device in Fig. 3 in which a permanent magnet *m* is fixedly mounted on the shaft *m'* which rotates in synchronism with the crank shaft of the internal combusiton engine.

A coil o is wound upon an iron core *n* and inserted, for example, in the grid circuit of the tube *e*, at *h*. It will thus be understood that a volt-

age impulse Eh is induced in the coil o with each change of the direction of the lines of magnetic force produced by the rotating magnet and passing through the coil o, whereby the tube e is ignited. Where a magnet m having one pair of poles is used, two changes of the direction of flux occur in the magnetic circuit of the coil o with each full revolution of the shaft m' and, as a result, two voltage impulses are produced per revolution. Therefore, in case of a four cylinder engine, the impulse generator shown in Fig. 3 should be driven with the speed of the crank shaft of the engine. On the other hand, where a magnet m having two pairs of poles is employed in a four cylinder engine, the impulse generator may be driven with the speed of the control shaft, the same as the shaft of the ignition distributor k.

In some instances it may be useful to provide a speed-controlled device for adjusting the ignition point, of known type, in the drive of the alternating current generator a or in the drive of the impulse generator, or where the impulse generator and the source of alternating current are constructed as an integral unit, in the common drive for the two devices. Such devices for adjusting the ignition point are indicated at V in Fig. 1, by dash and dot lines.

The method and apparatus of the present invention have been described in detail with reference to specific embodiments. It is to be understood, however, that the invention is not limited by such specific reference but is broader in scope and capable of other embodiments than those specifically described and illustrated in the drawing. More particularly, the invention is not restricted to the use of an ignition plant fed by alternating current. For example, a thyratron circuit producing relaxation oscillations may be used instead, comprising a condenser which is charged from a source of direct current and discharged in the ignition point of the engine through a valve and an ignition transformer. Also in this case the impulse for the discharge may come from an impulse generator interpolated in the anode or grid circuit of the gas discharge tube.

FRANZ DAUSINGER.

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JUNE 1, 1943.

BY A. P. C.

F. DAUSINGER
IGNITION DEVICE FOR INTERNAL
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Fig. 1

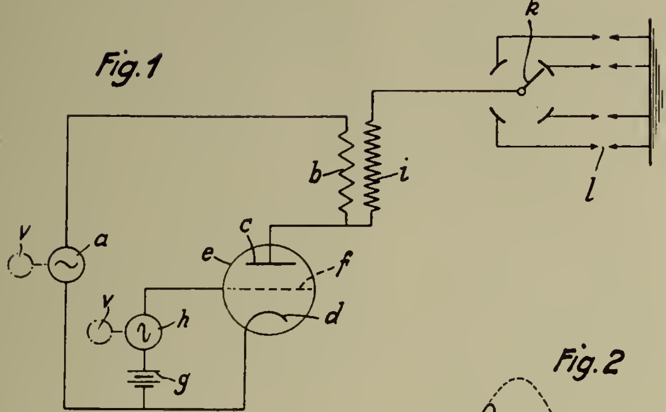
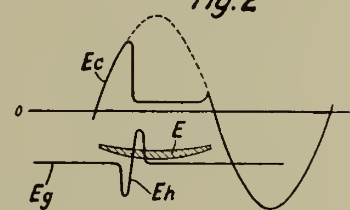


Fig. 2



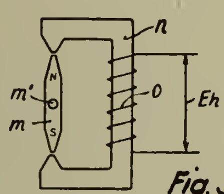


Fig. 3

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Franz Dausinger

By Roy F. Steward
his Attorney

Published June 1, 1943 Serial No. 323,475

ALIEN PROPERTY CUSTODIAN

SOAPS

Georges Croulard, Paris, France; vested in the Alien Property Custodian

No Drawing. Application filed March 11, 1940

It is common practice, in the manufacture of certain ordinary quality soaps, to incorporate in the paste a filling of more or less finely ground natural barium sulphate. This addition simply forms a filler which does not improve the quality of the soap, having just the reverse effect.

The addition of certain mineral or other substances to soaps offers however an undisputable advantage if it is carefully made, and it is known that the qualities of soaps are improved by the addition of very fine mineral substances such as osmotic kaolin or bentonite which are now commonly used for the manufacture of soaps, products of the saponification of vegetable or animal oils or fats, or products obtained by the saturation of oleic, palmitic or stearic acids with potash or soda.

But none of the substances hitherto used for this purpose has given entirely satisfactory results and this is more particularly the case of barium sulphate such as it has been used, that is to say in the form of ground natural barium sulphate. Even with a grinding which is carried farther than is possible in practice and after screening, the particles of natural barium sulphate have a crystalline form with sharp edges that exert an abrasive action on the skin, which differentiates it under the microscope from artificial or precipitated barium sulphate.

The essential qualities required of a filling material in order to improve soap are:

1. Fineness which increases the active surfaces, while preventing the formation, on the skin or the objects, of a "film" formed by the soap itself, and which thus enables the dirt to be coated and a better cleansing to be effected, as well as a more complete and easier rinsing;

2. Unctuousness that gives an agreeable sensation to the skin;

3. Whiteness and brightness (or absence of colouring) required for the good appearance of the soaps;

4. Non-toxicity;

5. Inertness with respect to the chemical constituents of the soap so that the added substance does not affect the preservation and the stability of said soap;

6. Homogeneity;

7. Shape of the particles as nearly as possible that of a sphere (maximum area) if they are crystalline, but more particularly devoid of sharp edges or points that may injure the skin and produce tiny sores into which the soapy micellae or the products of hydrolysis penetrate;

8. Possibility of obtaining a filling material which is very uniform as regards the whole of its qualities and even, optionally, of as great a chemical purity as possible.

Precipitated barium sulphate, which is a well-defined product that can be obtained at will in variable degrees of fineness and purity, possesses all these qualities as is proved by microscopical examination, its property in certain cases of even passing through paper filters, its use, by ingestion, for radiography, its absorbing power used in the manufacture of lacs, its insolubility, its whiteness, its brightness.

The present invention has for its object the use, for the improvement of soaps, of precipitated barium sulphate (precluding natural barium sulphate) of a size smaller than 10 microns and, preferably, of the order of 4 microns; it also covers the new industrial product formed by a soap in which such a precipitated barium sulphate has been incorporated.

It is found, when precipitated barium sulphate whereof the size of the particles is smaller than 10 microns, particularly if the precipitate has not been dried, is incorporated in any soap in the presence or not of triethanolamine palmitate, stearate or oleate emulsions or of the substance known in the trade by the name of "Tylose", that the soap thus obtained possesses a greater lathering power, faculty of cleansing the skin, linen or other materials, and softening power than those of the original soap. The colour of the latter is improved and if the original soap caused some pricking of the skin, this is very greatly decreased or even eliminated, as also is the adherence to basins or to razor blades.

According to whether it is proposed to obtain a soap for cleansing linen, the skin, the teeth, a shaving soap, a shampoo, a product for cleaning metals, glass, china, etc. or an industrial or pharmaceutical soap, it is possible to incorporate different quantities (varying from 1 to 90%) of the precipitated barium sulphate described above.

This incorporation may be effected in all soaps by any means and at any instant of the manufacture according to the requirements or the conveniences of same. For example, it is possible to make the addition before the saponification, or at the instant when salting out is effected before the addition of salt, or in the yet liquid soap paste, or even by dissolving an already made soap in a suitable quantity of water which is then evaporated until the required concentration is obtained, or in any other manner, even with a powdered soap. It would also be possible to incorporate the precipitated and dried barium sul-

phate in a powdered soap intended to be sold in that form.

An embodiment of the invention will now be described solely by way of example.

Start from an original soap having the following composition:

	Per cent
Moisture	25.83
Anhydrous fatty acids	63.40
Combined alkali	8.50
Free alkali	0.24
Sodium chloride	0.54
Glycerine	1.08
Sundry and losses	0.41
	100.00

In order to effect the incorporation of the preciptiated barium sulphate, dissolve 100 parts of this soap in 250 parts of water in the hot state.

Mix separately 25 parts of barium sulphate in the form of a paste (average size of the particles: 4 microns) with 0.5 to 1 part of the above soap, then add 20 parts of triethanolamine stearate emulsion containing 16% of fatty acid.

Introduce this mixture slowly into the soap in the hot state while stirring.

Then concentrate to the desired consistency.

Pour or mould into cakes.

The barium sulphate may be precipitated either before it is introduced into the mass intended to form the soap, or during the manufacture of the soap. In the latter case, products are incorporated in the mass in question, which are capable of producing precipitated barium sulphate.

The soap obtained according to the invention distinguishes very sharply in its properties from the known soap filled with natural barium sulphate, owing to the fact that precipitated barium sulphate, the use of which forms the fundamental feature of the invention, has absolutely different properties from those of the natural sulphate, even very finely ground.

GEORGES CROULARD.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF ALKALINE AZIDES

Josef Meissner, Koln-Bayenthal, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 18, 1940

This invention relates to improvements in or relating to the process for the production of alkaline azides.

Alkaline azides are formed by the action of nitrous oxide on alkaline amides, and the alkaline amides result from the conversion of the alkali metals with ammonia. These reactions proceed according to the following formulas:

$$2Na+2NH_3=2NaNH_2+H_2$$
$$2NaNH_2+N_2O=NaN_3+NaOH+NH_3$$

The alkaline azides are industrially produced as is known either in batches or in a continuous process. Thus, e. g., there has been proposed for carrying out the continuous process to introduce continuously equivalent quantities of gaseous ammonia and molten alkali metal, for example sodium, into a large excess of molten finished alkali amide, for example, sodium amide, and to convert in another zone the continuously discharging alkali amide with gaseous nitrous oxide in the presence of alkali azide and alkali hydroxide.

As well in the batch process as in the continuous process the alkali amide supplied is very easily caked with the alkali azide and alkali hydroxide still present from the reaction, this caking stopping the conversion to a large extent. In order to effect a complete conversion of the reaction components the caked mixture has repeatedly to be broken up.

According to the present invention these difficulties of the known processes are overcome by introducing the alkali amide into the reaction vessel for the conversion with nitrous oxide not, as hitherto performed, in the liquid but in a powdery state. It has namely been found that it is not necessary to introduce the alkali amide in a liquid form into the conversion apparatus.

The introduction of the alkali amide into the reaction vessel in a powdery state can be applied to the batch as well as in the continuous working process. On applying the process of the invention to the batch procedure, the time of the conversion of the alkali amide with the nitrous oxide can be shortened for three to four hours. The conversion can be carried out in a reaction drum mill known for this purpose and under the already known working conditions.

JOSEF MEISSNER.

Published June 1, 1943

Serial No. 325,908

ALIEN PROPERTY CUSTODIAN

GAS-CONCRETE MASS AND METHOD FOR ITS PRODUCTION

Erik Hüttemann, Niederlehme/Mark, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 25, 1940

In the known methods for preparing gas-concrete a so-called gas generator is mixed with the solid substances. The gas generator is a substance for instance aluminium powder, calcium powder, powder of aluminium alloys and so forth which reacts with the constituents of the mortar and preferably with the water, under development of gas. Notwithstanding the most uniform distribution of the gas generating substances an absolutely uniform structure of the concrete mass was never obtained. At certain points of the bodies of gas-concrete accumulations of gas or larger gas bubbles are present than at other points. The solidity is therefore considerably impaired. Further the larger gas bubbles escape more easily owing to their stronger buoyancy, this meaning a loss in gas formers.

The invention has for its object to ensure a uniform structure of the gas-concrete, which means that the gas bubbles are uniformly distributed in the mass. Another object of the invention is to obtain the greatest possible strength of the finished product. The invention has further for its object an economy in the quantity of gas formers which have to be employed.

It has been found that the strength properties are considerably improved, if the gas-concrete contains in such uniform distribution as possible gas bubbles of, at the utmost, 0.5 mm diameter, preferably of a diameter of about 0.005 to 0.5 mm or if bubbles of this size form at least the chief portion of the visible pores and are of closed shape in opposition to the known kinds of gas-concrete.

Gas-concrete masses of this character are obtained, according to the invention, by a special treatment of the gas former. It is for instance possible to obtain light building materials of a weight per unit of volume from 0.5 to 1.0 which, as regards strength, cold resisting property, insulating effect and so forth, are much superior to the known gas-concrete masses with this weight per unit of volume. A uniformity of the pore-distribution and an equalisation of the pore size may be obtained thereby, that the gas formers to be added to the mass are not used in the state in which they are supplied but are deposited as coating on a finely distributed carrier substance. This can be done for instance by grinding the gas former together with the mortar mass, preferably prior to the adition of the mixing water, this grinding together lasting for a long time, generally several hours. It is advisable to strongly deposit the gas former on to the carrier substance prior to the mixing in the mortar mass, especially prior to the addition to the mixing liquid.

One of the components of the mass or a portion of one of the components may serve as carrier substance. If the gas-concrete is formed, for instance, of cement and sand, a small calculated quantity of aluminium powder or the like can be added at the grinding of the cement clinker or at the grinding of a portion of the cement clinker. By the grinding this powder is deposited on the surfaces of the fine and finest cement particles which are formed. On the other hand, the aluminium powder or other powder can be ground into the sand or into a portion of the sand, before it is added to the gas-concrete raw mixture.

A special carrier substance, such as for instance pulverised slag, may further be used. Carrier substances are preferably used, which are harder than the substance developing the gas. In order to avoid detaching of the particles of aluminium powder or the like, the carrier substance may be united, at the mixing or before the mixing, with any sticking, preferably not water soluble substance, such as bituminous material, with wax, paraffine, resin, or similar substances.

Generally it is more favorable, to unite the gas developing powder and the carrier substance not in a mixing apparatus, but to grind the powder together with the sand or other substance for several hours, for instance in a ball mill. Generally, for instance when grinding with normal coarse-grained sand, a grinding duration of 5 hours will be sufficient. For softer substances, such as slag, 3 to 4 hours of grinding are already sufficient. On the other hand, the grinding period may be extended to 36 hours and more without any objection. By the grinding the adhesion is improved and at the same time the metal powder is extremely finely distributed, and so fine as it would be never possible when it were ground alone.

According to the invention the chief thing is, that the pores in the mass to be solidified are of very small size, because, with increasing fineness of the pores, the uniform distribution is still better ensured than with coarser pores, and because in this instance the danger is excluded that demixing may occur by rising of the gas bubbles to the surface. At the same time an economy in gas formers is attained, which amounts to approximately 20% compared with the known methods.

The manner and duration of the grinding de-

pends on the grinding apparatus used, on the type of gas former, and on the hardness of the carrier substance which is used. As a rule it has to be considered that, for instance at the grinding with aluminium powder, the carrier substance has to be disintegrated so much that on a sieve of 4900 meshes it leaves only a rest of at the utmost 10%. The material may be ground even much finer. For reasons of economy it is, however, advisable to not exceed a fineness of 5% rest on the 10000 mesh sieve. On the ground mixture it can be ascertained, that the gas former particles, which for instance with aluminium represent thin leaves before the grinding, adhere on the carrier particles as uniform coating.

The application on to the carrier substance, the uniting with the same and, if desired, the more extensive parcelling of the gas driving medium by grinding ensure, that in the mass to be raised no accumulation of gas raising media takes place at individual points, thereby otherwise at these points coarse pores would be produced. This was, as has been surprisingly ascertained, the chief reason for irregularity of the structure, for lowering of the strengths, for lacking frost resistance.

Experiments made by the inventor have shown, that for instance in a mass of gas-concrete to be produced from cement and sand with a weight per unit of volume of only 0.8 a strength of about 30 kg/qcm at the best could be attained according to the usual methods. If, however, $\frac{1}{10}$ of the quantity of the sand was ground during about 5 hours with the aluminium powder, the resistance rose to 80 kg/qcm, the weight per unit of volume of the gas-concrete being the same.

These figures show that by corresponding distribution of the pores, by keeping them uniform and further by the greatest possible reduction of the same, effects can be obtained which could not be expected.

In which manner the solidification of the bodies takes place, whether—as is possible when starting from cements or cement containing mixtures—by hardening on the air or by the action of steam under pressure, as is chiefly suitable when starting from common mortar, is indifferent. Any known hardening method may be employed, and also relative to the building-up of the raw mixture the widest range is allowed. Light stones of lime sand, for instance, can also be produced according to the new method.

It is particularly advisable to work, deviating from the usual method for producing gas-concrete, with masses poor in water, for instance with such masses which are near the plastic consistency. The quantity of water used in the method according to the invention can be reduced generally by about 20% compared with the known methods for producing gas-concrete.

Example

170 kg Portland cement, 380 kg sand flour (in the fineness of the usual Portland cement, which means about 10% rest on the sieve of 4900 mesh) are intimately mixed with 20 kg of a mixture of 20 kg ground sand and 350 g aluminium powder produced by grinding during 5 hours and with 440 l water. The mass is poured into molds and left to rise. The rising is terminated after about 30 minutes. The mass is then left standing for other 24 hours. The mass on top is then stripped off, and the bodies are removed from the molds after they have been stored again for 24 hours. They possess then sufficient handling strength. The bodies are then brought into hardening boilers and treated in them with steam of 10 atü during 8 hours. After the hardening drying of the bodies takes place.

ERIK HÜTTEMANN.

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ALIEN PROPERTY CUSTODIAN

PROCESS AND DEVICE FOR THE UTILISATION OF THE HEAT CONTAINED IN THERMAL OR ANYHOW WARM WATERS WITH THE OBJECT OF PRODUCING MOTIVE POWER

Luigi D'Amelio, Naples, Italy; vested in the Alien Property Custodian

Application filed March 29, 1940

The present invention relates to a process for the utilisation of the heat contained in thermal or anyhow warm waters with the object of producing motive power.

Object of the invention is equally a device allowing the realisation of such a process.

Besides thermal waters there may be considered as sources of thermic energy, to be utilised according to the invention, warm waters in general as for instance waste waters of industrial works and the like. The warm water at disposal has to be in presence of a convenient source of cold water or in exceptional cases in presence of cold air.

A form of realisation of the invention is illustrated in the accompanying drawing in which the only figure schematically shows an installation where the heat is utilised for actioning a turbine.

With reference to the drawing the warm water yields heat through metallic walls in a series of evaporators **1**, **1'**, **1''** . . . disposed in a cascade cycle evaporising a fluid of a high molecular weight and having an ebullition point of 760 mm mercury near to the atmospheric temperature considered about 15° C. A convenient fluid may be the normal butane with a molecular weight 58 (18 being the one of water), boiling at the atmospheric pressure of one centigrade. The water is through the connecting piece **7** admitted into the tubes of the first evaporator **1** at the temperature T_1 and exists at outlet **8** after yielding heat to the liquid in ebullition at the temperature $T_2<T_1$. The ebullition temperature of the fluid contained in the body of the evaporator **1** is slightly smaller than T_2 the difference being of some degrees centigrade for the good utilisation of the transmission through the wall. Before flowing to the subsequent evaporator **1'**, the water at the temperature T_2 feeds a pre-heater **2** of the motive liquid feeding the first evaporator taking the liquid from the second pre-heater **2'** by means of a pump **3**. The tepid water is then admitted in **7'** into the evaporator **1'**, from which after yielding heat to the fluid thereof exists in **8'** at the temperature $T_3<T_2$. The temperature of evaporation in **1'** is slightly smaller than T_3 for the said reasons. The water at temperature T_3 flows across a new pre-heater **2'** and passes to the thin evaporator **1''** and so on till it is definitively discharged after flowing through a last pre-heater **2''** fed by the condenser **6** through the pump **3''**. The number of evaporators may be fixed in an arbitrary way. Each pre-heater takes liquid from the inferior pre-heater in such a quantity that it will be sufficient for all the superior evaporators. The delivery of the different pumps **3''**, **3'**, **3** is consequently decreasing as the temperature of evaporation increases.

The elastic fluid is selected among those with a high molecular weight on the base of the physical principle that the discharging speed of a saturated vapour in an adiabatic expansion between two temperatures is with a good approximation inversely proportional to the square root of the molecular weight of the same vapour; consequently with the butane and isobutane, molecular weight being 58, there may be obtained in the useful interval of temperatures for tepid waters, namely between 100° C and 15° C, discharging speeds about the half of those to be reached with the steam in the same interval of temperature (molecular weight of water being 18).

Furthermore butane as well as isobutane are chosen owing to their characteristic thermodynamic propriety that in an adiabatic expansion, when starting from a saturated, dry vapour at the temperature T_1 instead of obtaining at the temperature T_2 a damp vapour, an overheated vapour is obtained, the superior limit curve in the entropy temperature diagram having, in the useful interval of temperature, that is between 10 and 100° C, the characteristic of an entropy increasing with the temperature. On the contrary the greater part of the other fluids present the superior limit curve with a decreasing entropy as the temperature increases.

This characteristic propriety allows in those machines which in absence of overheaters supply vapour generally saturated and damp, to produce, after the expansion, vapour deprived of humidity. The absence of humidity allows to suppress the braking and corroding action of the fluid on the turbine impeller, while the low discharging speed of the vapour allows the choice of a pure steam action turbine comprising an only wheel with a simple crown of blades though preserving a very good proportion between the peripheric speed of the wheel and the discharging speed of the vapour, equal to about 0,5. This could not have been possible with water steam reaching in said interval a discharging speed of about 1000 meters a second and a remarkable humidity after the adiabatic expansion.

The different evaporators are not filled with butane or other fluid of the same kind, but they contain water put into active circulation within the evaporator by means of convenient pumps **14**, **14'**, **14''**.

The butane or another liquid of the same type

is injected by the feeding pumps under the shape of very small drops, that is minutely fractioned, so that there is obtained with the water contained in the evaporator a species of emulsion. In such a way the water contained in the evaporator, owing to the high speed impressed by the circulation pump, relatively to the heating surfaces, allows a high coefficient of heat transmission between water and walls, while the minutely fractioned liquid, to be evaporated, establishes a very large separating surface between water and liquid, which, not being mixable in the water, evaporates with a total great coefficient of transmission.

The different water fed evaporators at a gradually decreasing temperature have consequently evaporation pressures, which, owing to the very small partial pressure of the water steam contained in the evaporator, may be considered as those of the saturated vapours of butane at the temperature taken by the internal water. These evaporation pressures of the butane will be, on their turn, decreasing from the first to the last evaporator. Supposing p, p', p'' . . . are the pressures respectively corresponding to 1, 1', 1'' . . . each evaporator feeds through the tubings 10, 10', 10'' . . . the nozzles 4, 4', 4'' . . . of the only turbine 5 disposed on a circumference concentric with the shaft 9. In each series of nozzles, the vapour, which may be considered of butane exclusively is expanded from the initial pressure of the respective evaporator to the final p_2, the only one for all, that is the one reigning in the condenser 6 and fixed by the quantity and temperature of the cold water at disposal. This water is admitted in the condenser in 11 and discharged in 12.

Consequently in the nozzle or series of nozzles 4 the vapour is expanded between the pressure p and the pressure p^2, in 4' between the pressures p' and p^2 and so on. As the pressures p, p', p'' are decreasing, the drops of pressures in the different nozzles are also decreasing and the discharging speeds of the different series of nozzles are equally decreasing from 4 to 4' to 4'' . . . . Supposing C, C', C'' to be the respective discharging speeds of the different series of the nozzles, all the series of nozzles feed all together an only action wheel with an only crown of blades 5. The nozzles are disposed in such a way that they may approach little by little the centre as their respective discharging speed is smaller. In this manner each series actions the blades of the turbine on a circumference of a gradually smaller radius and consequently with a gradually smaller peripheric speed. The distances from the centre of the different series of nozzles are such, that if C, C', C'' are the respective discharging speeds, they hit the blade in such points that

$$U/C,\ U'/C',\ U''/C'' \ . \ . \ . = Z$$

U, U', U'' . . . being the respective peripheric speeds in said points, and Z being, for an action turbine with an only wheel and a simple crown of blades, the very good ratio between the peripheric speed and the discharging speed equal to ½ cos α, α being the angle made by the jet with the plane of the wheel.

The blades may be consequently constructed with a constant inclination, that is comprising an only cylindric surface to be easily obtained.

The vapour discharged from the nozzles, after working in the wheel, is discharged at the common pressure p_2 through the channel 13 of the common condenser 6 from which, after the condensation, is sent back through the pump 3'' to the different evaporators through the pre-heaters.

The temperature of evaporation in the different evaporators is fixed as follows:

If T_c is the absolute temperature of the warm water at the admission in the first evaporator and T_f the temperature of the cold water at the exit from the condenser, supposing Δt the minimum diminution of temperature owing to the heat transmission through walls relating to the extension allowable of said temperature, supposing $T_o = T_c - \Delta t$ and $T_b = T_f + \Delta t$, if the evaporators are in number of n the absolute temperatures of evaporation of the 1st, 2nd, 3rd . . . nth evaporator indicated by T_1, T_2, T_3 . . . T_n there result:

$$T_1 = \sqrt[n+1]{T_o^n T_b},\quad T_2 = \sqrt[n+1]{T_o^{n-1} T_b^2},$$

$$T_3 = \sqrt[n+1]{T_o^{n-2} T_b^3},\ \ . \ . \ .\ \ T_n = \sqrt[n+1]{T_o T_b^n}$$

and for one whatever evaporator x

$$T_x = \sqrt[n+1]{T_o^{n+1-x} T_b^x}$$

corresponding to the conditions of maximum efficiency of the system of n evaporators. The number of evaporators may be even reduced to one, the general formula preserving its value.

The present invention has been illustrated and described in a preferred form of realisation but it is understood that constructive changes may be practically introduced therein without surpassing the limits of protection of the present industrial patent.

LUIGI D'AMELIO.

PUBLISHED

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BY A. P. C.

L. D'AMELIO

PROCESS AND DEVICE FOR THE UTILISATION OF THE HEAT CONTAINED IN THERMAL OR ANYHOW WARM WATERS WITH THE OBJECT OF PRODUCING MOTIVE POWER

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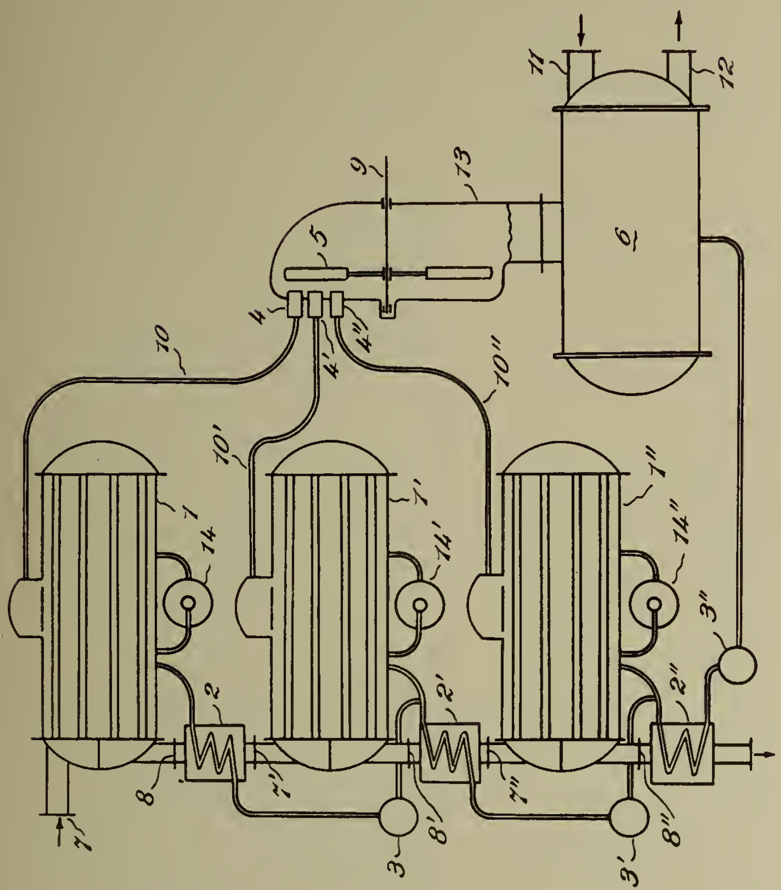

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ALIEN PROPERTY CUSTODIAN

LACQUERS AND A PROCESS OF APPLYING SAME

Guido Schultze, Mannheim, Germany; vested in the Alien Property Custodian

No Drawing. Application filed March 30, 1940

The present invention relates to new lacquers and a process of applying same.

Chloro-rubber is not very resistant to boiling liquids and possesses but a limited resistance to heat. It does not stand heating at about 150° C. and above without deterioration.

I have now found that very resistant coatings are obtained by coating the substrata with mixtures comprising (1) chloro-rubber, (2) hard resins, (3) alkyd resins or drying oils or blown drying oils, and (4) vulcanization accelerators and baking the coatings obtained. Among hard resins I may mention, besides natural resins, such as copal resins, especially hard artificial resins, as for example resinous condensation products, such as the phenol-formaldehyde resins or urea-formaldehyde resins, and resinous polymerization products, for example such as are obtained by polymerizing styrene in the presence of phenol. Alkyd resins suitable for the present purpose are the condensation products prepared from polyvalent alcohols and polybasic acids with the co-employment of monobasic (drying or non-drying) fatty acids or their esters. As vulcanization accelerators I may use any substance known as a vulcanization accelerator for rubber, as for example mercaptobenzothiazol, tetramethylthiurambisulphide and the piperidine salt of pentamethylenedithiocarbamic acid.

Chloro-rubber is preferably employed in a stabilized form. The stabilization may be effected according to any known method, for example in the manner described in the British patent 418,230. Plasticizers may be, but must not be added.

Advantageously the lacquers which are made up with the usual additions, such as solvents, and, if desired, pigments and the like, are allowed to ripen for some time, say several days, before being brushed or sprayed on. Lacquers are thus obtained which possess especially pale color. After the solvent has been evaporated the coatings are baked by heating them at fairly high temperatures, for example above 100°, usually between 120° and 200° C. and preferably between about 160° and about 180° C. for one or several hours. The coatings obtained are very hard and possess a high resilience and resistance to chemicals as well as to weathering.

The following Examples serve to illustrate how the present invention may be carried out in practice, but the invention is not restricted to these Examples. The parts are by weight.

Example 1

12 parts of chloro-rubber stabilized by means of about 2 per cent of phenoxypropene oxide, 12 parts of a resin obtained by condensing in known manner castor oil, phthalic acid and glycerine, 12 parts of a resin obtained by polymerizing styrene in the presence of phenol and 0.12 part of tetramethylthiurambisulphide are dissolved in 64 parts of xylene. The lacquer thus obtained is brushed on metallic substrata, for example sheet aluminium. After 30 minutes' drying in the air the coating is baked at 180° C. for an hour. The resulting coating is but scarcely yellowish, has an extraordinary firm adherence to the substratum and does not crack off when the latter is sharply bent or flexed. It is perfectly resistant to mineral oils and fuel mixtures and remains unattacked under the influence of soft soaps, tooth pastes and floor polishes; it also resists hot caustic soda solution.

Example 2

10 parts of chloro-rubber stabilized by means of about 2 per cent of phenoxypropene oxide, 12 parts of a resin obtained by the condensation of linseed oil, phthalic acid and glycerine, 8 parts of a resin obtained by alkaline condensation of tertiary butylphenol with formaldehyde and 0.12 part of mercaptobenzothiazol are dissolved in 64 parts of toluene. The solution is brushed on black sheet. After 30 minutes' drying in the air, the coating is baked for an hour at 160° C. A second coating of the same kind is applied to the sheet which is again dried in the air for ½ hour and baked for an hour at 160° C.

The brownish firmly adhering coating thus prepared is extremely hard and resistant to solvents, as benzene and benzine hydrocarbons, oil of turpentine and dilute hydrochloric acid.

Example 3

8 parts of chloro-rubber stabilized by means of about 2 per cent of phenoxypropene oxide, 16 parts of a resin obtained by polymerizing styrene in the presence of phenol, 12 parts of a mixture of 80 per cent of low viscosity linseed stand oil and 20 per cent of wood oil stand oil, and 0.12 part of tetramethylthiurambisulphide are dissolved in 64 parts of a mixture of toluene and xylene. After mixing in 18 parts of iron oxide red, the resulting lacquer is brushed on metal substrata, for example aluminium or light metal alloys or tinned sheet iron, and baked for 2 hours at from 140 to 150° C. after the solvent has been evaporated.

The coatings obtained have a good resilience and adhesive power and are resistant to weathering and to fuels. By adding plasticizers, such as chlordiphenyl, chlornaphthalene, benzylnaphthalene or acrylic acid polymerization products, lacquers of still greater resilience are obtained.

GUIDO SCHULTZE.

Published June 1, 1943

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ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF BASE EXCHANGE MATERIAL AND THE LIKE

Harald Nielsen, Lillerod, Denmark; vested in the Alien Property Custodian

Application filed April 5, 1940

This invention relates to the process of manufacture of a base exchange material, or so-called ion-exchange material more particularly from the non-plastic variety of clays, which are debris or weathering products of rock of vulcanic origin, and which in the form of fine particles are deposited and localized, particularly below, between and above coal measures of the late cretaceous or early tertiary geological ages as well as the so-called interbasaltic layers which may, or may not, originate from weathering of rock in the strict sense of the word, and more especially on the Faroe Islands.

It is a well-known fact that all clays, so-called plastic and non-plastic clays alike, possess base exchanging properties in a more or less pronounced degree when found in the natural state; this fact is for instance stated by way of an example in: "Berichte der deutschen keramischen Gesellschafts" Proceedings: Vol. 13, page 386 of 1932, by the authors Endell and Vagler. It is also a well-known and long established fact that the natural base exchange properties can be greatly enhanced by subjecting such material to the action of alkaline and common salt solutions, whereby, as is known, the insoluble silicic acid compounds obtain a greater charge of electricity of negative ions in the presence of water, and thereby get surrounded by a swarm of positively loaded exchanging ions. The mechanism of the base exchange is referred to in the proceedings of the above mentioned learned society, vol. 14, page 419 of 1933. It will thus be understood that the clay already in its raw state possesses base exchanging properties which may be enhanced by the subsequent treatment with alkalies or common salt in watery solutions. In order further to illustrate this fact, we will state an example: 100 grams of finely divided clay in its natural state as obtained from the coal-measures in the Faroe Isles. without being subjected to any chemical or other activating treatment previously, was shaken with three times its volume of water, possessing 24 British degrees of hardness for 15 minutes. After this treatment, the hardness of the said water was reduced from the original 24 degrees of hardness down to 11.5 British degrees of hardness, thus showing that the clay in its raw state possessed base exchanging properties. By the subsequent treatment of the clay with a weak solution of common salt, the base exchanging of the clay was increased to a $CaCO_3$ reduction from the said 24 degrees of hardness down to zero or 0 degrees.

It is also well-known that if clays are found that do not possess the base exchange property in the desired degree, or on account of the plastic nature is not stable in watery solutions, such clays may be fused together with other compounds, crushed to the desired grain size, or treated by chemical processes in order to obtain a granulating effect, and activated by being subjected to treatment with alkaline or salt solutions, by a process or processes as are well-known from the so-called "Permutit" water softening processes, by way of an example, or the so-called "Natrolit" by way of another example.

As the base exchanging properties of such materials greatly depend upon not only the electrostatic surface condition of such materials, but also on the total surface presented by any such material to the water of liquid to be treated, it will be understood that the greater the surface of the material per unit of volume in relation to the amount of water or liquid reated, the greater the effect obtained. Practical considerations, however, place a limit on the fineness of grain size permitted on an industrial scale, as the highly active and finely divided particles on account of the greatly increased surface tension tend to become suspended in the water or liquid undergoing treatment, in the form of dispersoids, etc., such particles may then be carried away by the liquid flow if practical speeds of such liquids be attempted, the carried away particles will thus not only constitute a contamination of the said liquid or water, but represent a considerable loss in valuable material.

The object of the invention is to avoid the above disadvantage, that is to say, to obtain from clays of the class above referred to, highly efficient base or ion exchange material having the most practical size of particle or grains for the purpose of obtaining maximum exposed surface while avoiding the risk of loss of material in finely divided form or as dispersoids which are liable to be carried away by the water flowing at the usual rate in water-softening plant, or by the counter-flow of water when the plant is flushed for the purpose of cleaning the base-exchange material, which is usually effected by reversing the flow of water for shorter or longer periods.

The invention may be briefly stated to consist in a process for treating non-plastic clay, such as that found in the coal measures of the Faroe Islands, for use as base-exchange material in water-softening plant, and so as to obtain a material of a granular form free from fines, and

to obtain a high percentage of granular material in relation to the fines eliminated, which process consists in subjecting the raw material to a regulated heat drying treatment, slacking the dried material with water to granulate it, removing any undesirable large piece of slackened material, and removing the fines from the remaining granular material.

By regulated heat drying is meant that,—as will be evident from the observations and experiments hereinafter given—the raw material, which may contain pieces of many different sizes, should be uniformly dried to the extent necessary to ensure the production of grains of the required size and with the least proportion of fines, for example, the drying may be effected in a heat dryer in which the period of drying is regulated according to the size of the material, so that the material of smaller size has a less period of drying than that of larger size for the purpose of ensuring that the bulk of the material will possess the degree of moisture necessary to give the desirable granular material on subsequent slacking with water and with the production of the minimum quantity of fines.

It has been observed that with clays, particularly of the non-plastic class, if the same material is always subjected to the same treatment to bring it into a granular form, it always has a definite size of grain. For this reason the raw material, according to our invention, is subjected to a carefully regulated heat treatment, which is preferably followed by a treatment, with water preferably in countercurrent and wet sifting as well as controlled water separation, as will be described in greater detail below in conjunction with accompanying drawing in order to obtain firstly a uniform sized material of the desired grain size, secondly for the removal of the very fine particles in the so-called wet way, and thirdly in order to obtain a stable-grained material by conducting the operations in such a way, that full advantage is taken by the natural cleavage of the raw material, it will, in this manner, be possible to obtain a material which, by being subjected to the ordinary working conditions in a filter or water-softening apparatus, will not disintegrate, neither by the base exchanging operations, nor by the subsequent regenerations with alkalies or salt solutions.

In order to illustrate the non-plastic class of clay with which our invention is concerned, we give by way of an example that which is found in the coal measures of the Faroe Islands and is of volcanic origin and has approximately the following chemical composition:

	Percent
SiO_2	41.6
CaO	0.90
MgO	0.04
Al_2O_3	32.80
Fe_2O_3	1.60
Alkalies	0.30

So-called fixed moisture about 11 to 15%.
Free or hygroscopic moisture 8 to 12% by 105°C.
Organic matters, a trace.
Loss by calcining about 20–22%.

It has been observed that by subjecting raw clay of the above analysis to a carefully controlled drying, it is possible to predetermine the size of the granules obtained by the subsequent addition of a controlled volume of water, preferably in countercurrent. It has been further observed, that the more the clay is dried or subjected to higher temperatures at prolonged periods of time, the smaller are the particles or granules obtained by subsequent slacking. It has in this connection been observed that it is primarily the contents of the free moisture before slacking which govern the ultimate particle size obtained, that is to say, if by the way of an example from two to three per cent of free moisture be removed from the clay by a regulated drying process, by far the largest percentage of the clay will slack or disintegrate into sizes of between 1 and 2 millimetres, but if the moisture percentage is further reduced or decreased, the result obtained will be different, as, by the slacking of the dried clay, there will be produced a larger quantity of undesired fines. This will naturally vary somewhat with the nature and origin of the non-plastic clay, the geological formation, the pressure exerted by the overburden, etc., but from our observations, it appears that there must exist some at present little known or understood relations between these factors in order to produce the specific cleavage or thereby graining of material in conjunction with the removal of the free moisture to a degree.

It has been found that by carrying out the process of regulated drying on a clay of the above or similar analysis of the non-plastic variety, where the relation Al_2O_3 divided by SiO_2 percentage, equals from 0.85 down to 0.40, the removal of a definite percentage of free moisture always corresponds to a certain degree of fineness in the resultant quantity of granules produced, and as a result of the application of our invention, we maintain, that it is possible at will to control in a large measure the average size of the predominating percentage of granules obtained by the subsequent slacking with water. The experiment stated below will serve to illustrate our contention.

5 kilograms of a raw, crushed clay sample, in lumps not exceeding 1″ cube were divided up into five parts, and dried to varying moisture contents under the same conditions.

Sample 1 had about 3% of free moisture removed by the drying and contained therefore 6% of free moisture; after drying the dried clay sample was slacked in water for half an hour, the disintegrated material was dried again to air-moisture equilibrium and a sieving analysis gave the following result:

	Per cent
Above 20 mesh (I. M. M.)	26.9
Between 20 and 60 mesh	64.6
Under 60 mesh (rejects)	8.5

Sample 2 was dried down to 5% of free moisture and on being subjected to the above treatment gave the following sieve analysis:

	Per cent
Above 20 mesh	16.9
Between 20 and 60 mesh	52.6
Below 60 mesh (rejects)	30.5

Sample 3, on being dried down to 3% of free moisture, gave on sieving the following analysis:

	Per cent
Above 20 mesh	14.2
Between 20 and 60 mesh	47.1
Below 60 mesh (rejects)	38.7

Sample 4 being dried down to 2% of free moisture, gave on sieving the following analysis.

	Per cent
Above 20 mesh	14.4
Between 20 and 60 mesh	47.6
Below 60 mesh (rejects)	38.0

Sample 5, on being dried down to 1% of free moisture gave on sieving the following analysis:

	Per cent
Above 20 mesh	16.1
Between 20 and 60 mesh	41.3
Below 60 mesh (rejects)	42.6

From this experiment, it will be clear that there is a definite reduction in size of the larger and wanted grains in the direction of the smaller and unwanted sizes (rejects), and it will, therefore, stand to reason that the regulated drying, that is to say, the reduction in free moisture content down from the percentage of moisture originally present in the raw material, is a matter of great importance in securing the desired maximum percentage of desired grain sizes by the slacking of the dried clay, as is made clear from the above stated experimental results. It has been found that the very fine dust, on account of the surface tension, adheres to the larger grains, and when placed in a water-softening apparatus tends to form mud that not only obstructs the free passage between the larger grains, but on regeneration in the well known manner with salt solutions for instance forms an almost impenetrable cake or layer on top of the material placed in the filter, thus also interfering with the efficient regeneration of the water softening material. It has also been found that when a material in the raw state has been dried too much, the tendency to continue disintegration during use is pronounced, the fine particles on subsequent flushing with water will therefore be carried away, and thus represent a material loss as well as a loss in efficiency of the filter or softener.

It has been found that in order to obtain the best technical and economical results, it is essential that the greatest attention be paid to the method of drying of the material, and the drying in a suitable manner is an essential part of our invention. It will be understood that the raw material on account of its nature must of necessity be available in greatly varying sizes, that is to say, any size from say 1 or two inch cube down to coarse powder, it will also be understood that by the ordinary drying, such as commonly resorted to, the smaller sizes will dry more quickly than the larger sizes, and if the drying period be the same, the smaller sizes stand the risk of being dried beyond the desired degree, with the subsequent drawback as mentioned above. Our invention, therefore, includes effecting the drying in such a manner that the smaller sizes of material are removed from the dryer at the correct period of drying in relation to the size, and the larger sizes later, so that the total or bulk of the material in this manner will possess the degree of moisture which will give the best grained material on subsequent slacking with water. The material, thus uniformly dried, may then enter a slacking container, preferably of the rotary type, in which the water required for the slacking is added in counterflow to the passage of the clay through the slacking container or drum. After the slacking, the material may be fed onto a shaking sieve of any well known type, partly submerged in water or any other suitable liquid, situated in a container, provided with an arrangement in any known form for the removal of any outsize material or grains that will not pass through the meshes of the sieve, the size of which should correspond to the grain of material wanted ultimately. The siftings may then be removed from the bottom of the container by means of any well known type of elevator, and discharged onto a second sieve of a similar design to the first mentioned sieve, but possessing meshes that will retain the smallest useable grain size, but permit the fines and adhered dust to pass through the shaking sieve, also partly submerged in water. In this manner, the correct sized grains will be freed from the dust which will eventually settle down to the bottom of the container, and be removed at suitable intervals, while the desired grain-size material by means of a suitable discharge device may be transported to a centrifugal dryer in order to effect the removal of the desired amount of free moisture from the material to a degree that will permit the safe storage without undue drying, if the material is not packed directly into water-softening apparatus, etc., after the usual activating with alkaline or salt solutions, such as is common to all base exchanging materials of this kind, whether of synthetic origin such as the so-called "Permutit" or natural such as green sands, etc.

The accompanying illustration diagrammatically indicates how, by way of an example, our invention may be carried out on a manufacturing scale.

A represents a suitable dryer, rotary or otherwise.

B inlet for raw clay to be dried. C. D. E. different outlets from the dryer for different sizes of raw material when dried to the required degree. F is the common collector for all the dried material. G represents a suitable slacking container, preferably of the rotary type. H is the inlet for the slacking water. I is the outlet for the surplus water. J is the discharge for the slacked material. K is the first semi or fully submerged shaking sieve, situated in the container L. M is the collector for the sieved material. O scraper for the removal of oversize material from the sieve. P outlet for oversize material. Q is discharge for sieved material. R is the second semi or fully submerged shaking sieve for retaining the correct sized material and through shaking-sieving in water effects the removal from the grains of the adhered fines and dust, which sinks to the bottom of sieve container S, from where the slurry, thus formed, may be removed through discharge opening S_1. By imparting the correct movement to the shaking sieve, the cleaned material of the correct sizes may be caused to travel forward and finally through outlet T pass on to centrifugal dryer U, from which the correctly dried material may be discharged through outlet X, while the separated water, passing away through V may subsequently be utilized in G for the further slacking of a fresh quantity of dried raw material.

It has been found that whereas a raw material of a similar kind or like nature, which has been indiscriminately dried without due regards to size or correct uniform moisture contents, will, on slacking, produce very uneven grained material with exceptionally large and uneconomical percentages of unuseable fines, and may even through the usual activation with alkalines or common salt solutions continue to disintegrate and cause serious losses in material through formation of a fine mud, which in the ordinary working by waterflushing will be washed away, that a raw material which has been treated according to our invention as set forth and described in detail above, not only slackens into very uniform sized grains, seemingly along some natural cleavage plane in the material itself, but

in a size that combines the maximum active surface with the most practical free space between the grains, thus permitting a free water flow without obstruction of excessive small grains, closely stuck together on account of the increased surface tension; furthermore, grains produced according to our invention as described, retain their grain size with a far less mud formation than by any other method known to us for the manufacture of water-softening or base exchange material of the stated kind. We find that the correct temperature treatment is of the utmost importance in securing the desired result, and according to our observations, non-plastic clays of this kind should not be subjected to drying temperatures exceeding 100 to 125° centigrade and for lump size one to maximum two inch cube, to which will correspond a drying period of about two to two and a half hours, furthermore, it is essential that all material dried, whether large or small, be dried to a uniform moisture content on a suitable dryer, as a continuous step in the whole process which will permit a separation in sizes during the drying, that will ensure the desired result in order to obtain the uniform clean grain size material desired of a stable type in operation. Uniform drying may be obtained, for example, by using a rotary type of dryer having circumferential sieves of increasing meshes so that the finer material will pass through the first sieve, the next coarser material through the next sieve and so on, so that the finer material has a shorter passage in the drum and, therefore, a shorter drying period than has the coarse material.

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MANUFACTURE OF BASE EXCHANGE
MATERIAL AND THE LIKE
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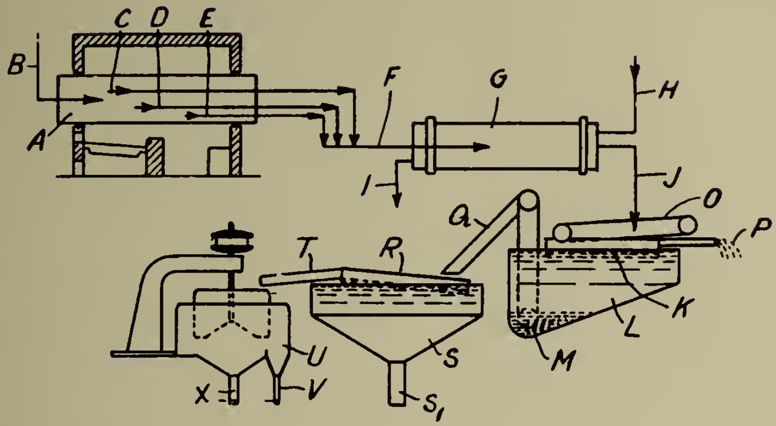

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ALIEN PROPERTY CUSTODIAN

GYROSCOPIC DEVICES

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This invention relates to gyroscopic devices adapted for use in aircraft, the rotor of which is electrically driven and which generates compressed air, which, for example, may be used for keeping the spin axis of a horizon gyro vertical.

For vertical gyros with air-driven rotors, it is known to use pairs of pendulums suspended on the rotor housing and swinging in front of control jets, whereby the air stream serving for the erection of the gyro may be alternately opened and closed. The use of such a pneumatic control device is difficult with gyros having electric drive for the rotor, because the stream of control air generated by the rotor depends in its action upon the amount of air furnished, and this again depends upon the altitude at which the craft is flying.

According to the present invention, a regulating device is provided for the control air, which serves the purpose of keeping the control effect constant at different altitudes. For this purpose the product of air jet pressure and useful air jet cross section is kept constant.

The use of the invention in connection with a gyro-vertical will be further described by means of the drawings. However, the invention if suitably modified, may also be used with azimuth gyros, which in known manner are made to follow the position of a magnetic system by means of a pneumatic control device.

Fig. 1 is a longitudinal section of the gyro-vertical.

Fig. 2 is a horizontal section of the device through the gimbal ring and the gyro rotor housing in the plane of the gimbal bearings, showing the gyro rotor.

The gyro rotor **10** is supported in bearings **12** and **13** for spinning about a vertical axis **11**. These bearings are mounted in the housing **14** surrounding the rotor. This housing may oscillate around the horizontal axis on trunnions **15** and **16**, journalled in the gimbal frame **17**, which in turn is carried by fixed bearings **18** and **19**.

Three-phase alternating current is used to drive the gyro rotor, the current being conducted to the stator winding **24'** by means of springs **20—22** and **23—25**, respectively, and through the gimbal bearings **18** and **15'**. The stator **24'** is carried by the member **25'** mounted in the lower part **14'** of the gyro rotor housing. The rotor **10**, which surrounds the stator, has a short-circuited winding **26** in which eddy currents are induced by the rotating field of the winding **24'**, whereby the rotor is revolved.

On top of the rotor is mounted a blower-like member **27**, with fins, which receives air through a number of openings **28** through which the air may be sucked into the housing. The air flows in the direction shown by the small arrows, around the gyro rotor into the lower part of the housing and from there through passages **29** and the holes in a disc **30**, into a projection **31** attached to the gyro rotor housing.

In this housing projection, a piston **32** is movable in an axial direction. The air flows through the passages **33** from the piston into a ring-shaped space **34**, whence it emerges into the atmosphere through the control ports **35**. In known manner, four control ports have been provided, two of which (not visible in the drawing) are located in a plane perpendicular to the plane of the paper. The two opposing ports **35** are alternately covered by pendulum valves **38** and **39**, which are fastened to a shaft **36**. The other two pendulums (not visible in the drawing) are supported on an axis **37**, perpendicular to the axis **36**, so that the pendulums swing in a plane parallel to the paper. If the gyro rotor axis deviates from the true vertical, the four air jets will be influenced to different amounts so that a reaction torque is generated which precesses the gyro directly back into the vertical, as well known in art.

According to the present invention, the air jets are all controlled by the piston **32**. A spring **40**, which is fastened on one end to the fixed disc **30** and on the other end to a screw **41**, which may be adjusted with respect to the piston, tries to move the piston upwardly, and thereby to open the ports **35** entirely. This motion is counteracted by the air pressure against the piston, the amount of which is dependent upon the outer atmosphere. The greater the density of the surrounding air, the greater is the amount of air moved and the higher, therefore, the pressure acting upon the piston. The spring **40** is so adjusted that the effective opening or cross section of the control ports is enlarged in proportion to the decrease in pressure. Obviously the reaction torque acting upon the gyro is equal to the product of pressure times cross section.

In order to obtain the least amount of friction in the motion of the piston, the same is provided with ring-shaped notches **42**. In lieu thereof, a suitably formed lining provided with the notches may be fitted into the housing projection **31**. In this case, the piston may be kept smooth without notches and may be produced with extremely thin walls, which is of great advantage with respect to weight. It is necessary that the weight

of the piston be negligible as compared with the weight of the gyro, so that small changes of position of the piston do not appreciably change the position of the center of gravity.

Instead of varying the effective cross section of the control ports in accordance with the change of pressure of the air provided by the blower, the arrangement may be such that with constant cross section, the jet pressure of the control air is kept constant. The simplest way of doing this is by leading the control air through a throttling valve, the cross section of which is controlled by means of a pressure regulator controlled by the jet pressure and the atmospheric pressure.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from thes scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

BENNO RYBKA.

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GYROSCOPIC DEVICES

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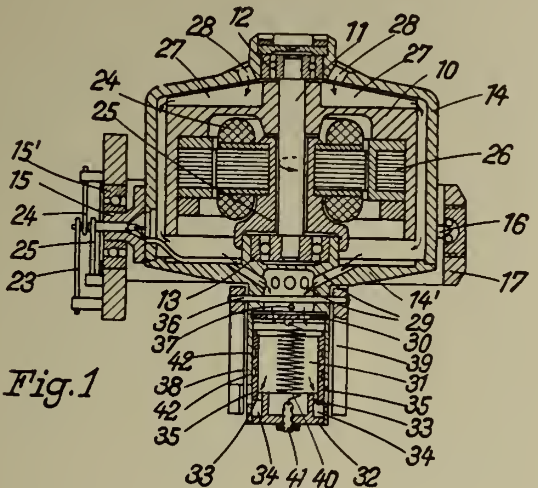

Fig.1

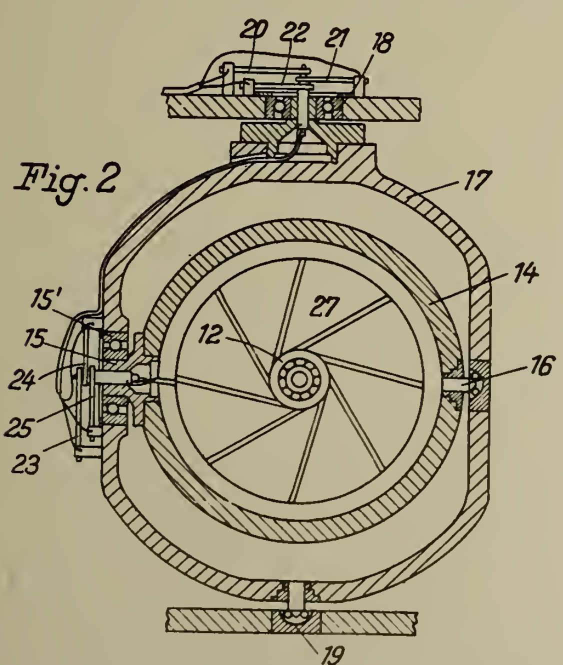

Fig.2

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ALIEN PROPERTY CUSTODIAN

MECHANISM FOR TRANSMITTING MOTION

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Application filed April 11, 1940

This invention relates to motion transmitting mechanisms, and more particularly to a motion transmitting mechanism comprising speed changing means, and as accessories an irreversibility device, a selective speed initiating and stopping means, and means for limiting the period of operation, adjustable as desired.

The invention is concerned more particularly with the application of these different means to controlling the change of pitch of the blades of a variable pitch propeller, said invention being of especial interest in this connection.

It is a matter of common knowledge that in order to use an aircraft motor or engine to the best advantage it is customary to vary the adjustment of the pitch of the propeller blades during flight. In view of the very considerable inertia possessed by the propeller this adjustment should as a general rule be effected slowly in order to avoid suction phenomena. On the other hand certain special operations should be effected very rapidly as distinguished from operations effected under normal flying conditions. For example, to damp or brake in diving, the pitch of the blades must be quickly reversed, while to reduce the resistance to progress in case of engine failure the blades must be positioned quickly with their edges substantially fore and aft. These different conditions call for the use of means for changing the speed which shall enable the pitch of the blades to be changed slowly or rapidly.

Another object of the invention is to provide in speed varying means, comprising reducing means consisting of a wheel connected to the driving shaft, a wheel coaxial with said shaft and connected to the organ to be driven, a set of coaxial pinions which may be united as one and each meshing with one of said wheels, the arrangement of as many suitable sets of pinions about said wheels as there are different speeds to be provided for or as the dimensions of said wheels and pinions permit.

The invention and its aforesaid aims and objects, as well as such others as may hereinafter appear, will be clearly understood from the following description, taken in connection with the accompanying drawing of embodiments of the invention herein given for illustrative purposes, the true scope of the invention being pointed out in the appended claims.

In the drawing:

Fig. 1 is a side view partially in section of the blade pitch control, the lower portion of said figure showing a differential blade pitch indicator;

Fig. 2 is a front view, partially in section, of the speed changing means pertaining to the blade pitch control;

Fig. 3 is a detail of one of the cam slots provided in a gear wheel provided in the blade pitch control;

Fig. 4 is a view, partly in section, of auxiliary electric means enabling the blade pitch control for positioning the blades with their edges substantially fore and aft, to be controlled or operated by an auxiliary motor;

Figs. 5, 6, 7, 8 and 9 are different views of irreversibility means pertaining to the blade pitch control, and

Fig. 10 shows the lower part of Fig. 1 on an enlarged scale.

The illustrative embodiment of the speed changing control shown in Figs. 1 and 2, comprises a driving shaft **1** and a hub **2** splined thereon and carrying blades **3**, wheels **4** for controlling said blades, and worms **5** for controlling said wheels, said worms being driven by pinions **6** meshing with a toothed wheel **7** integral with a wheel **8** (see Fig. 10). Said toothed wheel **7** and wheel **8** are adapted to rotate loosely as a unit upon a wheel **9** which is integral with hub **2**. (See Fig. 1.) In accordance with the invention sets of pinions **10***a*, **11***a*, **10***b*, **11***b*, etc., are disposed about said wheels **8** and **9**. Said pinions are carried upon spindles mounted in a housing **12** and may be brought into mesh with one another by any suitable means, in the present instance by mechanical clutches. By varying the number of teeth of said pinions the gear transmission ratio may be varied within quite wide limits. It has been established that the number of the teeth of the pinions which mesh with said wheels may be varied within quite large proportions while still remaining within acceptable limits for the modification of the moduli or of errors in the spacing of the spindles.

In the illustrative embodiment of the invention shown in Figs. 1 and 2 there are six sets of pinions as follows:

A set of pinions **10***a*, **11***a* each having a number of teeth such that if both be thrown into gear, the pinions of the other sets being out of gear, wheel **8** will rotate slightly faster than wheel **9**. This is the set of pinions for slowly increasing the blade pitch;

A set of pinions **10***b*, **11***b* having a number of teeth such that wheel **8** will rotate slightly slower than wheel **9** when said pinions are thrown into gear, the pinions of the other sets being out of gear. This is the set of pinions for slowly reducing the blade pitch;

A set of pinions **10c**, **11c** having a number of teeth such that when said pinions are in gear, those of the other sets being out of gear, said wheel **8** will rotate much more quickly than wheel **9**. This is the set of pinions for quickly increasing the blade pitch;

A set of pinions **10***d*, **11***d* having a number of teeth such that when said pinions are in gear,

the other sets being out of gear, said wheel 8 will rotate much less rapidly than said wheel 9. This is the set of pinions for quickly reducing the blade pitch;

A set of pinions 10*e*, 11*e*, also forming part of the invention, but having a different function from those above referred to. The number of teeth of this set is such that when said pinions rotate at the same speed, wheels 8 and 9 also rotate at the same speed. Pinion 10*e* is rigidly connected to a spindle or shaft 13 upon which is splined a pinion 14. Pinion 11*e* is rigidly connected to a pinion 15 having the same number of teeth as said pinion 14. A system of satellite pinions mounted upon a toothed wheel 16, which is loosely mounted relatively to pinions 10 and 11, comprises two sets of pinions 17 and 18 having the same number of teeth and loosely mounted relatively to each other, said pinion 17 meshing with a toothed wheel 19 which is fixed relatively to the housing 12, and said pinion 18 meshing with an internal toothed wheel 20 which controls the pitch indicator means. From the above description it will be clear that said wheel 20 will rotate in one direction or the other through a number of revolutions proportional to the angle through which pinion 10 rotates relatively to said pinion 11. This device will be used as an indicator of the blade pitch, movement of said wheel 20 being transmitted to any suitable conventional indicator by any suitable conventional transmission means;

A set of pinions 10*f* and 11*f* having the same number of teeth as said pinions 10*e* and 11*e*. This set of pinions has a different function in accordance with the invention. When said pinions are in gear the pinions of the other sets being out of gear, they compel wheels 8 and 9 to rotate at the same speed, thus forming a locking means for the blade pitch control. This function could be discharge by pinions 10*e* and 11*e* of the blade pitch indicator means, if said pinions were provided with suitable clutch means.

It will be apparent to those skilled in the art that other sets of pinions could be provided in accordance with the invention of which the number of teeth could be such that the speeds of rotation of said wheel 8 would differ more and more from those of said wheel 9. Intermediate sets of pinions could also be intercalated between said aforementioned pinions and said wheel so as to increase the gear ratio. Thus, instead of driving said wheels 8 and 9 by a set of pinions for rapidly increasing the blade pitch, said set of pinions could be caused to drive said set of pinions for slowly increasing the blade pitch, said two sets of pinions being provided with selective means for throwing one set into gear when the other is out of gear. The errors or moduli or in the spacing of the spindles of said sets would thus be divided between the two sets instead of falling entirely on one, in the most unfavorable case.

The sets of pinions must of course be selectively thrown into and out of gear. This can be readily accomplished by providing each set with any suitable means to that end, an electro-magnetic clutch for example, and means such as a switch to control the current so as to throw the clutch of the one or the other set in or out. In any case said clutches will be so dimensioned that in case of excess coupling or the untimely operation of several clutches at once, the clutches shall slip and thus avoid damage. Such slip can occur without any risk, the relative speed of said pinions 10 and 11 being always very low.

Another object of the present invention is to provide a selective, mechanical clutch control which shall meet the following conditions:

1. The irreversibility pinions 10*f* and 11*f* should be slightly thrown out before throwing in either of the sets of pinions 10, 11;

2. Impossibility of throwing in more than one set of pinions at the same time;

3. Yielding operation of the clutch in case the teeth of a clutch should not happen to be in line with their receiving sockets, a situation which could exist for only a very short time on account of the constant angular displacement of the pinions in rotating;

4. Direct positive throwing out of the clutch without the intervention of any yielding means.

Said clutch control may be greatly simplified by the following considerations as regards security. If the slow and the rapid increase of the blade pitch be thrown in simultaneously, the latter will prevail. Therefore it is only necessary to use ratchet claws or dogs. This applies equally to the rapid and the slow reduction of the blade pitch. The irreversibility may also be obtained by using a friction clutch with limited couple. It only remains therefore to provide the system of security between the increase and the decrease of the blade pitch. Better still, the decrease of the blade pitch requires but little effort and can therefore be effected by a friction clutch with a limited couple. Security is therefore really only indispensable between the slow and rapid increase and rapid decrease of the blade pitch.

The clutch control or operation is effected, in the illustrative embodiment of the invention, by a toothed wheel 21 provided with inclined cam slots 22*a*, 22*b*, . . . etc., of which the shape is shown in Fig. 3. Levers 23*a*, 23*b* . . . etc. engage said slots with one end and are connected to a toothed wheel 24 movably mounted upon a sleeve 25 at one end of which is a shoulder 26 integral with the movable member of the clutch. A helical spring 27 is tensioned between said wheel 24 and said shoulder 26. Said wheel 21 in rotating swings said lever 22 to the right or to the left. The movement to the right throws out the clutch and is positive, that to the left throws the clutch in and is effected yieldingly through spring 27. Said cam slots 22*a*, 22*b*, . . . etc. are so positioned on said wheel 21 that for five positions of the latter said cam slots produce the following combinations:

1. Mean position, dead center:

$\left.\begin{array}{l}10c,\ 11c\\10b,\ 11b\\10a,\ 11a\\10d,\ 11d\end{array}\right\}$ thrown out

10*f*, 11*f* thrown in

2. Intermediate position at each side of mean position:
   - 10*b*, 11*b* thrown in, all the others being thrown out; slow reduction of pitch.
   - 10*a*, 11*a* thrown in, all the others being thrown out; slow increase of pitch.

3. Each end position:
   - 10*c*, 11*c* thrown in, all others being thrown out; rapid increase of pitch.
   - 10*d*, 11*d* thrown in, all others being thrown out; rapid decrease of pitch.

Said wheel 8 is driven by a toothed wheel 28 which in turn is driven by a rack 29. The latter

may be driven by any suitable means, for example hydraulically or pneumatically by a set of fluid actuated pistons **30**, **31**. Compressed fluid may be supplied to said pistons from any suitable conventional source, not shown. Means are provided normally to maintain said rack in its median position, said means herein conveniently comprising a set of springs **32**, **33**. Mechanism identical to that just described is mounted symmetrically in respect to the vertical axis of Fig. 2. These two mechanisms are mechanically connected by the common wheel **21** and two wheels **28** and **28'**. This symmetrical mechanism is not shown but its parts will be referred to in the following description, the parts thereof identical to those of the mechanism above described being identified by the same reference characters as the latter but primed. Suitable means **34** is provided for adjusting said rack both angularly and axially, as well as safety means, herein illustratively comprising a fork **35** rigidly united to a piston **36** actuated by any suitable means, preferably by fluid from the same source of supply as that above referred to, said piston being moved in one direction by said fluid pressure and in the other direction by an antagonistic spring **37**. The rack at the right of Fig. 2 is part of the control for increasing the blade pitch, its counterpart at the left not shown as above stated, being part of the control for decreasing the blade pitch. The selective mechanical operating mechanism above described operates as follows:

To increase the blade pitch slowly compressed fluid under medium pressure is admitted through a port **38** into the annular space between pistons **30** and **31**. Piston **30** will thus be forced downwardly, carrying with it said rack **29**, while rack **29'** on the other hand will be moved in the opposite direction, thus compressing a spring **33'** by operation of a piston **30'**. When the bottom **39'** of rack **29'** contacts with the end of piston **31'**, movement of pistons **30** and **31'** will be arrested, the fluid pressure being insufficient simultaneously to compress the three springs **33'**, **32** and **32'**. Furthermore the safety device **35** being in engagement with adjusting means **34**, arrests further movement of said rack **29**. To effect rapid increase of the blade pitch, fluid under greater pressure is introduced through port **38**. The fluid pressure thus obtained is sufficient on the one hand to counterbalance the action of spring **37** and raise piston **36**, thus at the same time freeing adjusting means **34**, and on the other hand to compress springs **33'**, **32** and **32'**. Piston **30** can thus move between the corresponding position of contact of **39'** with the end of piston **31'** and the bottom of cylinder **40**. The stroke of piston **30** or rack **29**, and consequently of the angle of rotation of toothed wheel **21** are divided into two parts, one part corresponding to the travel from the mean position of equilibrium to the position wherein adjusting means **34** abuts against fork **35** or the bottom **39'** of rack **29'** contacts with the end of **31'**, for slowly increasing the blade pitch, and the other part corresponding to the travel from the latter position to that of contact between piston **30** and the bottom of cylinder **40**, for rapidly increasing the blade pitch. The slow as well as the rapid decrease of the blade pitch are obtained in the same manner by supplying said left side symmetrical mechanism with fluid under different degrees of pressure, the travel of the racks being reversed, as is also the rotation of the toothed wheel **21** relatively to the mean position.

The invention also comprises means for automatically limiting the movement of the blades to the position in which their edges are directed fore and aft, high pitch front-high pitch back, low pitch front-low pitch back . . . etc., which makes for great security and easy control of the position of the propeller. This means is operated preferably by the differential means for indicating the position of the blades, above described. In the illustrative embodiment of the invention shown, it comprises a toothed wheel **42** centered in the housing **12** and operated by a wheel **42** integral with a toothed wheel provided with dogs for clutching it to a toothed wheel corresponding to wheel **20** of the differential means for indicating the blade pitch. Said toothed wheel enables pinions **10** and **11** to be thrown out of gear in well defined positions. To this end said toothed wheel comprises adjustable dogs which, in its rotation are adapted to engage levers **43** which act directly upon said shoulder **26** and when operated throw the corresponding sets of pinions out of gear.

To render this operation more secure, pinion **10***d*, normally operated to place the propeller blades in said fore and aft position, may have splined thereon a toothed wheel **44** which is mounted upon the shaft of an electric motor **45** supplied with electricity from any suitable conventional source, from a battery for example, Fig. 4. The propeller blades may thus be placed in position with their edges fore and aft, in the event of a complete stoppage of the driving engine. Normally the last few turns of the engine before it stops completely should suffice to effect this operation.

Instead of using the irreversibility means comprising the set of the two pinions **10***f* and **11***f*, one may use the following device illustrated in Figs. 5, 6, 7, 8 and 9 and which comprises in the illustrative embodiment of the invention, a channelled sleeve **46** mounted upon the shanks of worms **5** and to which is affixed a coaxial annular member provided with slots **47**; a housing **48** is mounted upon said member and is shaped to leave an annular space between it and said member and in which is lodged a spring **49**, preferably a square-bar-spiral spring having one end forming a shoulder **30** lodged in a socket **51** in said sleeve **46**. Said spring is carried by said housing **48** and is under an initial tension. Said pinion **6**, which rotates said worm **5** by means of said sleeve upon which it is splined, is provided with dogs **52**, herein four, adapted to engage said slots **47** with a certain amount of play. One of said dogs is longer than the others and is adapted to engage the free end of said spring **49**. Said channelled sleeve has a number of channels which is primary with the number of teeth or dogs of said pinion **6**, thus providing for a very exact adjustment of the angular position of the blades relatively to the operating means.

The above-described arrangement enables said worms to be driven by said pinions **6** but absolutely precludes any transmission of movement from said worms to said pinions to decrease the blade pitch. As clearly appears from Fig. 7, worm **5** turning in the direction of the arrow, carries the sleeve **46** and the end of said spring **49** along with it. Said spring under this traction and its initial tension is drawn out, binding still more on the part of said housing **48**, its free end being free to move a distance equal to the play between the wall of said slot **47** and said dog **52**. In view of the tightening of said spring, the great

winding angle of the latter rapidly attains a point at which said spring becomes locked. On the contrary, when the transmission of movement is from said pinion to said worm, that is to say when said worm is driven normally, said spring cannot cause the locking action referred to. Indeed, when said pinion drives said worm in the direction indicated by the arrow in Fig. 8, to pass from high pitch to low pitch, pinion **6** begins to move relatively to sleeve **46**, through an angle corresponding to the play allowed between the wall of said slot and said dog **52**. In this movement the dog in question of said pinion **6** presses upon the free end of said spring in the direction tending to unwind the latter, thus nullifying the initial tension of said spring when said dog **52** encounters the wall of the slot of said sleeve **46** in which it is engaged. Said sleeve as well as the no longer tensioned spring and said worm **5**, on the shank of which said sleeve is splined, are all driven but said untensioned spring no longer exerts any locking or braking action. For the change from low pitch to high pitch, said pinion **6** rotates in the direction indicated on Fig. 9 and the particular dog **52** engaging said particular slot **47** in said sleeve **46** abuts against the wall of said slot, said sleeve **46** being carried along by reason of the engagement of its end **50** in said socket **51**. The force exerted upon said spring being in the direction tending to unwind it, the resistance opposed by said spring to said movement can never exceed that of its initial tension, which is negligible. The irreversibility has herein been used only in the case of the reduction of the pitch, which is all that is required in practice, but it will be apparent that this feature of irreversibility could be applied in the case of the increase of the pitch as well as in the case of the decrease thereof, that is to say to effecting rotation in both directions, for example by using two springs wound in opposite directions and suitably driven by a member similar to said dog **52**.

The present invention can be applied to any transmission using the different objects thereof.

CAMILLE DUCHAUSSOY.

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C. DUCHAUSSOY
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Serial No.
329,155
5 Sheets-Sheet 1

Fig. 1

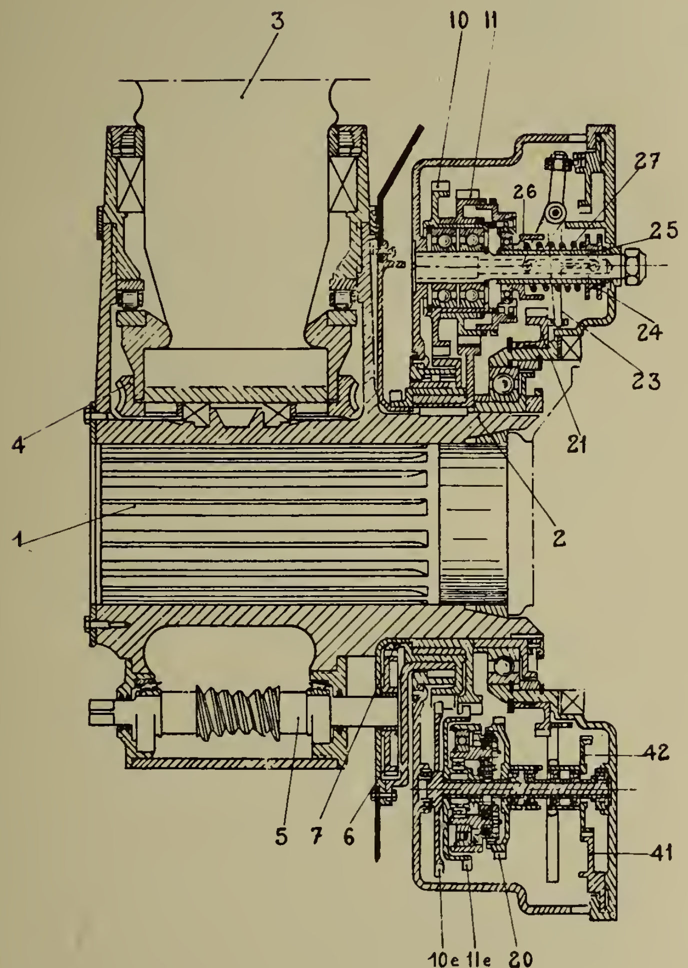

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Fig. 2

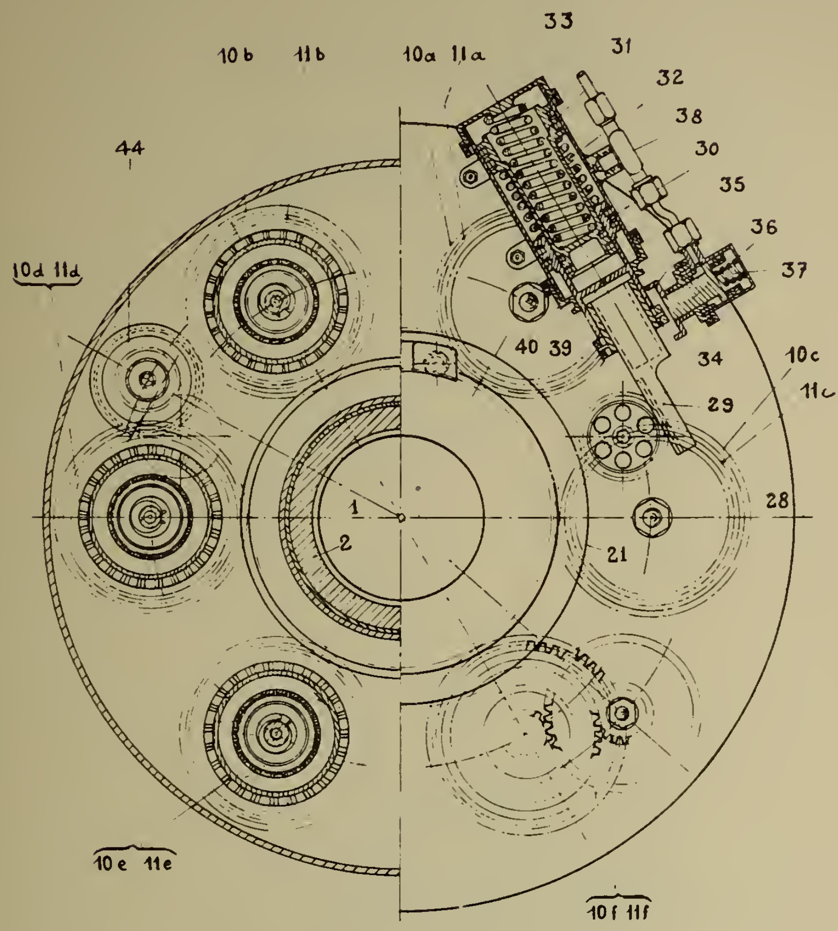

Fig. 3

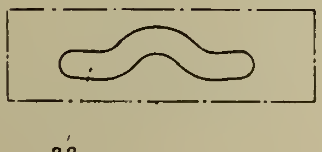

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Fig. 4

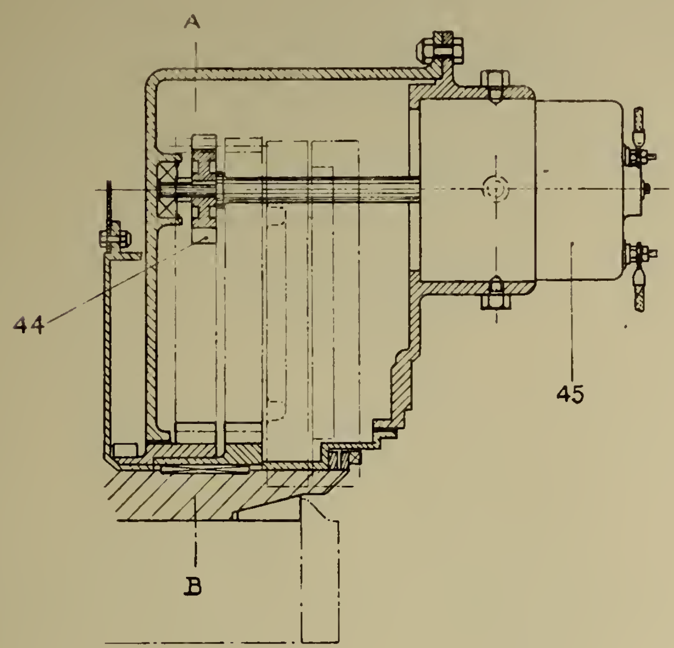
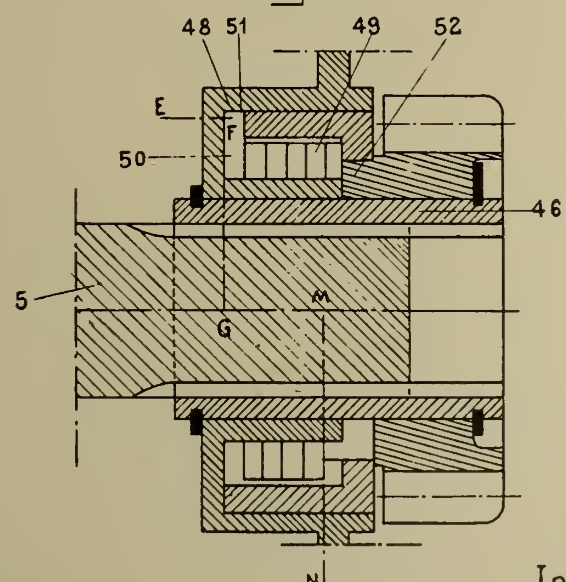


Fig. 5



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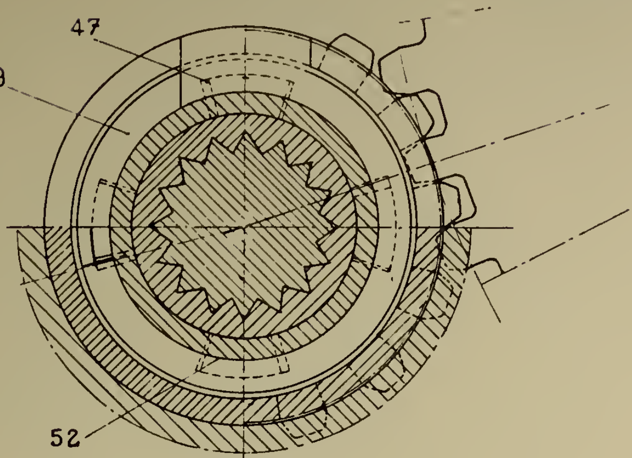

Fig. 6

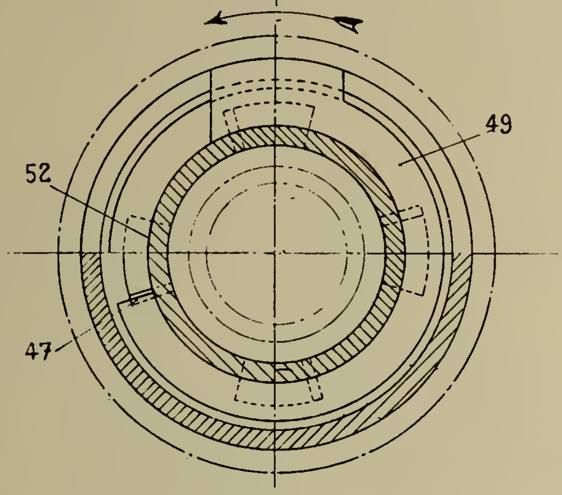

Fig. 7

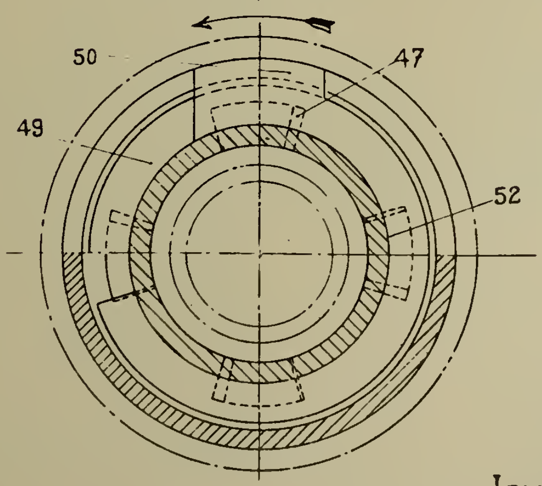

Fig. 8

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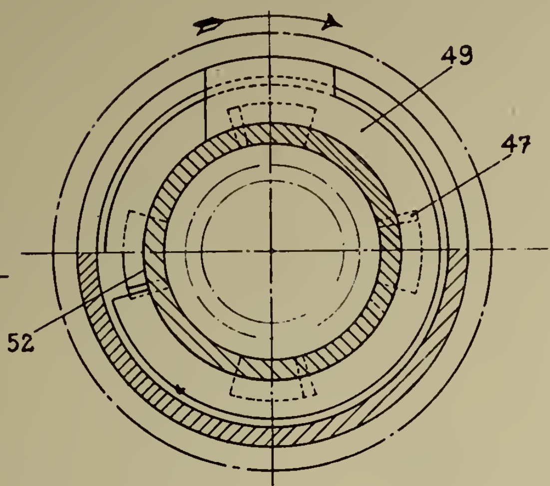

Fig. 9

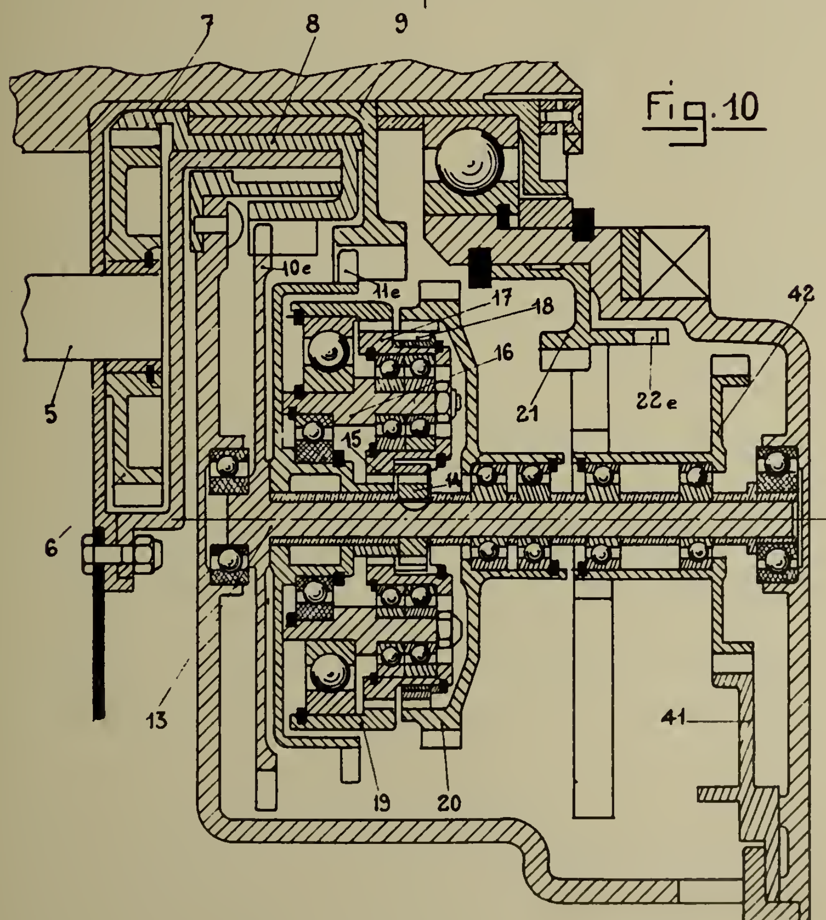

Fig. 10

Inventor

Published June 1, 1943 Serial No. 332,711

ALIEN PROPERTY CUSTODIAN

CIRCULATION SYSTEMS OF PULP DIGESTERS

Ivan Penry Troëdsson, Tokyo, Japan; vested in the Alien Property Custodian

Application filed May 1, 1940

This invention refers to an improvement in circulation systems of pulp digesters at which a forced circulation of the mixture of pulp and liquid in the digester is obtained by means of a pump, placed in a pipe line connecting the lower and the upper parts of the digester, and at which a strainer for drawing off surplus liquid, and thereby keeping the liquid level constant, is arranged at the upper part of the digester.

The invention consists in arranging one or more rotary or oscillating bodies, such as propellers or similar devices, at the inlet of the suction part of the stated pipe line and close to the drawing-off strainer for the purpose of obtaining a uniform flow into the piping, and preventing the piping and the pump as well as the drawing-off strainer from being clogged and choked by the chips or the pulp.

The object of the invention is to make it possible to use forced circulation systems when cooking certain raw materials which have such a consistency that circulation by hitherto known arrangements is impossible. One such raw material is, for instance, bagasse. Such raw materials have a tendency to pack hard in the digester, and to form more or less large lumps which are liable to choke the circulation piping and cause the circulation to stop. They may also accumulate on the draw-off strainer so that it becomes impossible to draw off the surplus liquid. The present invention aims at removing operating difficulties of this kind.

The invention is illustrated in the attached drawing, in which 1 indicates the digester, 2 the circulation pump, 3 the suction pipe to the pump 2, 4 the pressure pipe from pump 2, 5 the rotary or oscillating body which is mounted on the shaft 6, and driven, for instance by the pulley 7 or in some other known way, 8 is the drawing-off strainer.

The mixture of pulp and cooking liquid is drawn by the pump 2 via the rotary body 5 into the suction pipe 3 in the upper part of the digester, and after passing the pump 2 is returned by way of the pressure pipe 4 into the lower part of the digester. The rotating body 5 breaks up any agglomerations of chips or pulp so that the flow into the suction piping becomes smooth and unobstructed. At the same time the rotary body 5 prevents any chips or pulp from settling on the drawing-off strainer 8.

The attached drawing shows only one way of applying the invention. It is however possible also to apply the invention at such circulation systems where the circulating cooking liquid is separated from the pulp by means of a strainer placed before the suction pipe to the pump, and at which the practically fibre-free liquid only enters the circulation piping and the pump. At such circulating systems the strainer might gradually become choked with chips and pulp, but by using the rotary or oscillating body as described above the strainer can be kept clean, so that the circulation will work smoothly.

IVAN PENRY TROËDSSON.

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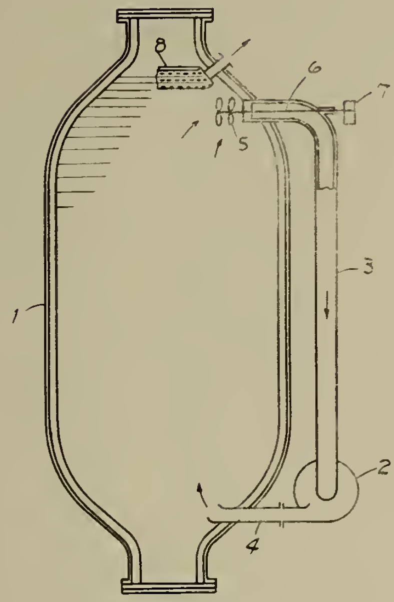
BY A. P. C.

I. P. TROËDSSON

CIRCULATION SYSTEMS OF PULP DIGESTERS

Filed May 1, 1940

Serial No. 332,711



Ivan Penry Troëdsson
INVENTOR

BY Otto Munk

his ATTORNEY

Published June 1, 1943

Serial No. 333,775

ALIEN PROPERTY CUSTODIAN

PURIFICATION OF SULPHUR DIOXIDE GASES

Josef Bayer, Ludwigshafen-on-Rhine, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 7, 1940

The present invention relates to a process of purifying sulphur dioxide gases as they are obtained by roasting ores and the like.

For the purification of the said roasting gases in order to catalytically convert them into sulphuric acid, it has been proposed to introduce sulphur trioxide into the gases. In order to cool down the hot gases coming from the roasting process and to precipitate suspended substances, the gases are, prior to the supply of sulphur trioxide, treated with sulphuric acids of increasing strength in trickling towers and then purified in iron tubes by electric precipitation.

The pretreatment must be carried out in lead-lined towers or brick-lined leaded towers, the said acids of increasing strength being fed through leaden pumps. As the gas in the towers has only a comparatively low speed of flow, the mist contained or formed therein is for their greater part precipitated. The sulphuric acid mist contained in the roasting gas is thus lost as a precipitant for the subsequent electric purification. In their place, therefore, new mist must be produced by a supply of sulphur trioxide and water or dilute acid, which means a comparatievly high expenditure of sulphur trioxide. For this reason and because of the comparatively high expense for equipment and lead, the process could not be adopted in practice.

I have now found that the cooling and purification of the roasting gases may be carried out in iron apparatus if the gases, either in the roasting furnaces or between or behind the dust chambers, are admixed with sulphur trioxide in such an amount that the precipitated sulphuric acid has a concentration of at least about 88 per cent. of H_2SO_4. The contaminations contained in the roasting gas are thereupon all separated out in iron tubes by the electric purification, together with the sulphuric acid precipitating, the concentration of which practically ranges between 88 and 96 per cent. The proportion of impure acid obtained only amounts to about 7 to 8 per cent. of the products. This acid may be purified in known manner. The process in accordance with my present invention makes lead practically dispensable as a constructional material in the erection of a plant for the catalytic production of sulphuric acid. For the said reason and, moreover, by avoiding the arrangement of several trickling towers, connected in series and being fed by large amounts of acid, the cost for the plant is essentially cut down.

For the electric purification of roasting gases with a view of removing arsenic, selenium and the like, it has been proposed to add sulphur trioxide, whether in all refining stages or only in the last stage. This known process only concerns the final treatment of the gases and not the problem of carrying through the whole course of working up the gases so as to carry out the purification completely in iron apparatus, as is the case in the process according to the present invention. According to my process the sulphur trioxide is added to the roasting gases already before their cooling and electric purification, i. e. in the roasting furnace or between or behind the dust chambers.

The following example serves to illustrate how my present invention may be carried out in practice, but the invention is not restricted to this example.

Example

A gas obtained by roasting pyrite and coming from the dust chambers connected to the roasting furnace with a content of 8.5 per cent. of sulphur dioxide, is given an addition of 12 grams of sulphur trioxide per each cubic meter at about 200°C. The gas is then cooled in a wrought-iron cooler to about 35°C and then passed through a wrought-iron chamber fitted with sparkling wires being under a tension of 10,000 volts.

The gas thus purified contains only 0.0002 per cent. of arsenic. In the purification 34 grams of a 96 per cent. sulphuric acid are formed per each cubic meter of roasting gas. This acid contains about 0.22 per cent. of arsenic which is eliminated in the usual manner.

JOSEF BAYER.

Published June 1, 1943 Serial No. 333,186

ALIEN PROPERTY CUSTODIAN

METHOD FOR PRODUCING LAYERS ON SOLID OBJECTS

Walter Geffcken and Edwin Berger, Jena, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 3, 1940

The reflection occasioned on the outer surface of a transparent object when light rays from the air pass into that object, same as the reflection occasioned when light rays from a transparent object pass into the air, can be diminished in a known manner by applying to the object a thin layer of a substance whose refractive index is lower than that of the object in question. Suitable choice of this refractive index of this substance and of the thickness of the layer provided, it is even possible to wholly eliminate said reflection. It is furthermore known that the said reflection can be diminished by the application of several thin layers, though it is not expedient in that case that all of them have a lower refractive index than the object. However, the previously known methods for producing such layers are unsatisfactory, because, for instance, of the layers obtained thereby offering little resistance to chemical or mechanical attacks.

According to the invention highly effective layers offering strong resistance at the same time to chemical and mechanical attacks can be obtained if for their production a low-hydrated gel-like hydroxide (either alone or with other additions) of an element capable of forming colloidal hydroxides difficultly soluble in water is precipitated on the object when the latter is heated to a temperature which lies at least 50° below its fusing temperature. In place of a single one of such hydroxides also a mixture of several hydroxides can be used. Precipitation can be effected thereby in the most various ways; for instance, by precipitating the hydroxide from vapors, or applying it mechanically by the atomising of solutions of the hydroxides; furthermore by dipping the object to be coated into the solution and thereby producing upon it a film of that solution.

The production of hydroxides can be effected in known manner by the chemical decomposition of salts containing the respective elements in the form of acidifiers, furthermore by substances separating H-ions, as through the precipitation for instance of sodium silicate solutions with the aid of muriatic acid or by the action of water or of other substances separating hydroxide groups either on halides or on other similarly decomposable compounds (as ester, f. i.,) of the elements in question.

On the hydroxides thus obtained being colloidally dissolved in water or in organic liquids the objects to be treated can by dipping, pouring or spraying etc. be coated with a more or less thick layer, or with several such layers, hardening colloidally as the solvent evaporates. By careful heating the gelatines loose more or less of the solvent and the hydrate water still held by them and thereby shrink in a manner numerically determinable by preliminary tests until they form very thin layers of good durability both in a mechanical and chemical respect. At the same time their refractive index changes so that their finally effective refractive index must be determined before the more exact production of reflection-diminishing layers can be proceeded with.

The final stage of the hardening of the gelatines is generally reached when heated to a temperature of not exceeding 250° C., at which stage low-hydrated layers of hydroxide of the respective elements have been arrived at. This hardening can also be effected while the layers are being produced in that the hydroxides or a mixture of them is precipitated upon the more or less heated objects by the atomisation, for instance, of their colloidal solutions.

What very likely is the simplest method of producing uniform layers is to expose the object to a fog formed of the substance to be precipitated. Fogs of this kind and of particularly fine dispersal are obtained if a vapor-flux of a compound decomposable by water is allowed to mix with steam, say, by spraying the halide with the aid of a nozzle upon the object located in room-air.

A rather low refractive index being already obtainable, for instance, with water-containing layers of silico-oxide, the application of one single layer is in many instances sufficient for producing an adequate diminution of the surface reflection. Its performance can be still further enhanced in that, during or after precipitation, evaporatable, or decomposable substances as well as substances, separatable by chemical means, such as f. i. paraffines, organic acids or their salts etc., are made effective and embedded by heating. By greater heating as well as by chemical decomposition or other reactions these substances or parts of them can then be removed again thus resulting in a porous structure of the hardened layer of hydroxide and bringing about a lower refractive index without decreasing the mechanical resisting capacity.

Layers of a particularly pronounced resisting capacity and of a refractive index, which can be as low as about 1.4 and still go beyond 2.0, are obtainable when proceeding from the hydroxides of tungsten, molybdenum, or from elements of the third group of the periodic system, furthermore, from the fourth group excepting carbon, or from the fifth group with the exception of nitrogen, provisions being made that each of the

finally produced layers consist to a least one half of a hydroxide of one of these elements or of a mixture of same. To produce highly refractive layers it is advisable to proceed from the hydroxides of titanium, circonium, tin or lead, while for lowly refractive layers the hydroxides of aluminium or silicon should be proceeded from. Lanthanium, tantalium and thorium are likewise well-suited for producing highly refractive layers, but are less resorted to on account of their high prices. By way of example, it may be mentioned that the refractive index of a low-hydrated layer of silicon hydroxide is about 1.45 and that of a low-hydrated layer of titanium hydroxide about 2.10.

Even though the application of the invention being of particular significance for diminishing the reflecting capacity of transparent objects it can also be of importance in applying such layers for other than the specified purposes. It is thus available for instance, for producing very dense and chemically resistant layers completely protecting the object underneath them from corrosion. This may be of importance not only for objects made of chemically sensitive glasses, but also for such objects consisting of metallic or organic substances, capable of swelling, etc. Thus, for instance, the blackening of silvered mirrors can be prevented and the reflexion of aluminium mirrors not only maintained at its initial value, but even increased beyond that value. The invention is furthermore applicable for retouchings on optical surfaces. If for this purpose the refractive index of the layer is chosen equal to that of the glass the retouchings will be entirely invisible, so that they may be applied in the form of secret characters, for instance, discernable but under special conditions, say, by the interferometric observation of differences in thickness. Furthermore, it will be possible to make use of such properties of the said layers as, for instance, their susceptibility to liquids, their altered surface (catalytic) effect or their electrical properties, etc.

It is know that, for decorative purposes, layers causing interference colors (so-called iridescent lustre-colors) can be produced on objects of glass by exposing the latter to metallic-salt vapors or spraying them with solutions of metallic salts after having previously heated said objects to fusing temperature. The method suggested according to the present invention differs from these known methods in that it is carried through at a temperature lying at least 50° below the fusing temperature, as otherwise the surfaces to be treated would become unsuitable for optical purposes; actually, the method applied for can even be carried through, in general, without resorting to temperatures higher than 250° C.

When carrying through the new method certain difficulties may be encountered, inasmuch as layers of a more or less pronounced diffusing power, i. e., surfaces of a smoky to milky appearance, may easily result. This defect may accentuatedly appear when spraying a fog of colloidal solutions (particularly in the case of titanium and silicic acid) as well as during the decomposition in damp air of such halides reacting strongly when in contact with aqueous vapor, as titanium tetrachloride ($TiCl_4$) of aluminium trichloride ($AlCl_3$), for instance. Although this defect being presumably avoidable by a careful control of the humidity of the air and by a substantial rarification of the gas-flux, much more simple and reliable methods are, however, to be preferred. A favorable effect is, for instance, obtained by adding to $TiCl_4$-vapor a reactive halide-carrier, as silicon tetrachloride ($SiCl_4$), for instance. Gaseous muriatic acid has a similar effect. The use of $SiCl_4$ offers the advantage that it can be mixed in liquid state with $TiCl_4$ in any desirable proportion. What furthermore proved to be very expedient is that the excessive volatility of the halides or their mixture can be reduced by dissolving them in an indifferent solvent, organic neutral halides, particularly carbon tetrachloride (CCl_4), for instance, being quite useful. A suitable mixture, for instance, consists of 3 volume parts of $TiCl_4$, of 1 volume part $SiCl_4$ and of 10 volume parts CCl_4. Spraying this mixture through a nozzle, in room-air, onto a plate heated to over 100°, an entirely clear gel-layer is formed of so high a refractive index which practically precludes the presence of any Si, thus representing a pure gel-layer of TiO_2. With $AlCl_3$ conditions are similar to those ruling in the case of $TiCl_4$.

A further difficulty consists in certain halides, as for instance, silicon tetrachloride ($SiCl_4$) and silicon tetrabromide ($SiBr_4$), at low temperature (below 400° C), reacting only slowly in the desired manner with gaseous water, but quickly with liquid water. It consequently is not so easy to produce a layer on a plate if the latter is heated to more than 100° C, but not to over 400° C. At room temperature, however, fine fogs of muriatic acid are formed which appear to act as nuclei of condensation for the segregation of liquid water as there is a precipitation on the plates of clear silicon gel-layers if brought into the said fog. The condensation in question, however, being that of minute droplets, the uniform susceptibility to liquids of the base and its perfect cleanliness play an important part, as otherwise stained and irregular coatings will result. By the admixture of phosphorous oxychloride which, perhaps, may have a condensating effect, the uniformity of the precipitation can be considerably improved. Also a mixture of heated $SiCl_4$-vapor and super-heated aqueous vapor has proved advantageous. All these substances cannot, however, be fully turned to account, because of the greatest part of the halides escaping in the form of vapor which latter, moreover, are attacking and injurious to health. Neither it is possible thereby to obtain the precipitate on a plate whose temperature exceeds 100° C. That temperature, however, is desirable if the TiO_2 and SiO_2 is intended to be applied in one operation and the mixture of both substances possibly to be arrived at. A far better solution of this problem consists in a flux of combustible gases instead of air being used and in the gas being ignited when leading the nozzle. This considerably accelerates the reaction, resulting in thick white clouds of smoke being given off. As the gas used must not produce any soot, hydrogen, for instance, would be recommendable, though this may lead to the reappearance of the aforementioned defect, viz., the formation of a cloudy film. However, by the introduction of an indifferent gas, as nitrogen, for instance,—which permits of a reduction of the flame temperature down to 800° C. a clear coating can be obtained. Besides that, the introduction will be expedient of slight quantities of oxygen as in that case, even if lowered by a further 100° C, the flame temperature can be maintained relatively uniform and an extinction prevented. In this manner it is possible to achieve a SiO_2—precipitate on plates heated to

more than 100° C, i. e., to maintain the same conditions applying in the case of TiO_2. This, furthermore, makes it possible to avoid the halides so inconvenient in handling, and to adopt organic compounds as volatiles since the organic portion of the latter are entirely consumed at the flame temperatures in question. Alkyl esters, as for instance methyl and ethyl ester of silicon, or acetyl acetonates as aluminium and acetyl acetonate, for instance, are well suited for this purpose.

The method described above embodies a special advantage in that it permits the production of layers whose refractive index lies anywhere between the refractive indices of two substances. This can be accomplished by the alternative application of very thin layers consisting of two substances of a different refractive index. Thus, if the object to be treated is placed upon a rotating disc and consecutively subjected to the spray of one nozzle for the TiO_2-layers and to the spray of another nozzle for the TiO_2-layers, a multiple sequence of infinitely thin SiO_2 and TiO_2-containing layers will result. Since after 200 revolutions, for instance, the total thickness of the layers amounts to only about 1 μ, the thickness of a single layer only amounts to about 5 Å, i. e., to the magnitude of a molecule-layer. It is to be presumed now that what has been produced are not actually uniform layers of the said thickness, but that several molecule layers were deposited in some places and none at all in others, so that a structure is very likely to result coming very near to the actual nature of a mixture. Yet, even if the structure were assumed to represent a sharply defined stratification, the effect of such a sequence, optically, would be similar to that of a mixture. It can be approximately computed by the rule of mixtures as that of a mean refractive index n resulting from the equation

$$n=\frac{p}{100}n_1+\frac{100-p}{100}n_2$$

where p is the percentage of the content of the totality of layers in the substance having a refractive index of n_1, and where n_2 is the refractive index of the other substance. In this manner it also is possible to produce layers which have the same refractive index as the object to be coated and therefore represent entirely invisible layers.

The following examples are given to demonstrate the diminution in reflection achievable with the method proposed in the present invention.

By applying to a glass plate of a refractive index 1.89 a layer of SiO_2 it will be possible, by a suitable choice of the thickness of this layer, to obtain a reflection value of 0.3% for a prescribed wavelength, as for 485 mμ (green) for instance, whereas in the case of a non-coated glass plate the reflection value would amount to almost 10%. For the remaining wavelengths the reflection will be somewhat higher amounting to 1%, for instance, for 560 mμ (yellow). With a glass plate having a refractive index of 1.50 the reflection, by the same treatment, can be diminished to 2.9% at the best. However, if on a glass plate of a refractive index of 1.50 a layer of TiO_2 is applied and on top of this a layer of SiO_2 it will be possible to make the reflection for a prescribed wavelength vanish entirely.

WALTER GEFFCKEN.
EDWIN BERGER.

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ALIEN PROPERTY CUSTODIAN

CARBON BODY AND METAL HOLDER UNIT

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Application filed May 8, 1940

This invention relates to a combined carbon body and metal holder unit of the type used, for example, for contact brushes and more particularly, for brakes.

In units of the type referred to it is difficult to provide an intimate physical connection between the carbon body and its metal holder. The difficulties arise mainly from the fact that the carbon and metal parts have different physical properties and, more particularly, different coefficients of thermal expansion.

It is an object of the present invention to remove these difficulties and to provide a design in which an intimate connection is created and the carbon body is reliably secured to its metal holder without the danger of undue stresses or tensions exerted upon the carbon body by its holder.

With this and further objects in view, as may become apparent from the within disclosures, the invention consists not only in the structures herein pointed out and illustrated by the drawing, but includes further structures coming within the scope of what hereinafter may be claimed.

The character of the invention, however, may be best understood by reference to certain of its structural forms, as illustrated by the accompanying drawing in which:—

Fig. 1 is a cross sectional view of a known unit of the type referred to.

Fig. 2 is a longitudinal section through the same unit.

Fig. 3 is a similar view as Fig. 1, but having the invention applied thereto.

Fig. 4 is the same view as Fig. 3, but showing the parts after shrinking of the metal holder.

Figs. 5 and 6 are longitudinal sections of the arrangements of Fig. 3 and 4, respectively.

Similar reference numerals denote similar parts in the different views.

Referring now to the drawings in greater detail, Figs. 1 and 2 show the condition of the carbon body and metal holder as it may result where the holder is cast around the carbon body. Owing to the considerable shrinking pressure exerted upon the carbon material cracks are formed at *c* and *c'* which in turn cause the holder to bend round and form spaces as indicated at *d*. Moreover, due to the longitudinal shrinking the carbon body is bent down whereby the head of the carbon body is separated from the foot portion as indicated at *c''* in Fig. 2.

I avoid the said defects by the interposition of an elastic bolster P between the carbon body *b* and its holder *a*, which bolster is embodied in the casting or shrinking operation. The bolster may be of a metallic nature and may consist, for example, of soft copper or aluminum texture or sponge of a thickness corresponding to the amount by which the metal holder will shrink as it is cooling down. Accordingly the texture will be made thicker where a strong and large holder is provided and thinner in case of a thin holder. In each case the bolster material must be of a thickness to be completely compressed after the shrinking of the metal holder. By reason of the shrinking pressure of the surrounding holder it is tightly and completely pressed against the carbon material *b* and in addition it is penetrated by the cast metal of the metal holder *a*.

It will thus be understood that any pressures exerted upon the carbon body *b* by the bolster *a* are compensated by the metal bolster P, whereby a very intimate connection is attained between the carbon and metal holder material while there are no mechanical tensions any more between the top part of the carbon body and the dovetail or foot portion thereof.

As shown by comparison of Figs. 3 and 4, or 5 and 6 respectively, the porous metal bolster P (texture or sponge) of Figs. 3 and 5 is compressed to the dense and much thinner layer P, Figs. 4 and 6 without exerting any excessive pressure upon the carbon body which would cause destruction of the carbon material in the manner as indicated in Figs. 1 and 2.

Figs. 5 and 6 will also make it clear that there is no bending stress exerted upon the carbon body, owing to the uniform and intimate contact between the holder and the carbon body, ensured by the interposed buffer layer P so that there is no danger for the head portion of the carbon body to burst off.

While the figures are especially designed for a carbon body and metal holder unit of the type used as a trolley brush or collector bow for electric railways and the like, my invention may also be applied with very good success for other purposes where a carbon body has to be secured in a metal holder or vice versa. For example, brake blocks of carbon material may be secured in metal holders of iron or cast steel material, steel being used with a view to the high stresses produced by the high pressures with which the carbon blocks are forced against the surface to be braked. However, the shrinking coefficient of iron and cast steel amounts to about 6%. i. e., it is even much higher than that of light metals of the type used as a holder material for electric metal contact devices. Therefore, the danger of

the carbon body being destroyed by the shrinking pressure of the metal holder is even higher in this case. Now, by the provision of intermediate bolster layers of the type above referred to and indicated at P in Figs. 3–6, the carbon body may be protected against any undue pressures.

It will be understood that the interposed bolster material must be heat-proof up to the temperatures occurring by application of the metal holder to the carbon body. For example, where a cast steel holder is applied, the bolster material must be designed to stand the annealing temperature of cast steel.

Where the carbon bodies are not intended to transmit any electric current, such as in the case of brake blocks, non metallic, fire-proof or refractory bolster materials may be used to damp and receive the shrinking pressures of the metal holder. For example, mineral material, asbestos, slag wool, silicate cotton, cinder hair and the like may be used in the form of a texture or loose mass which is compressed as the surrounding metal casting is shrinking together.

It is also contemplated that bolsters of the type referred to may be applied where the metal holder is combined with the carbon body in a heated, but solid condition of the holder, by a mere shrinking operation.

The method and apparatus of the present invention have been described in detail with reference to specific embodiments. It is to be understood, however, that the invention is not limited by such specific reference but is broader in scope and capable of other embodiments than those specifically described and illustrated in the drawing.

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CARBON BODY AND METAL HOLDER UNIT
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Fig. 1

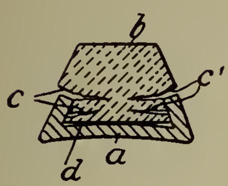


Fig. 2

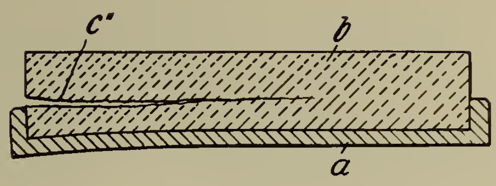


Fig. 3

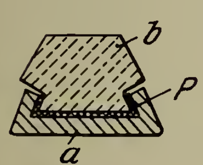


Fig. 5

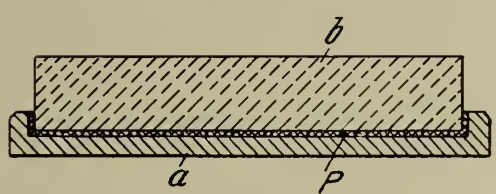


Fig. 4

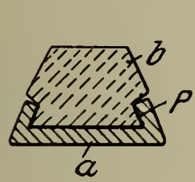
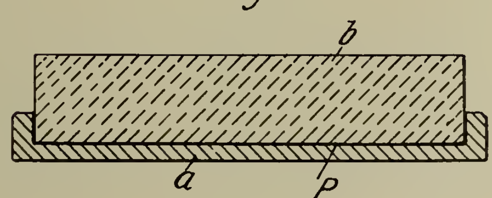


Fig. 6



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Attorneys

Published June 1, 1943

Serial No. 334,093

ALIEN PROPERTY CUSTODIAN

CONTACT DEVICE

Friedrich Leuchs, Nurnberg, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 8, 1940

This invention relates to a method of producing contact devices for feeding or receiving electric current, by combining a carbon body with a metal support.

Contact devices of carbon for feeding or receiving electric current are known in which a metal support is cast around or upon the carbon body, for example, in the form of contact fingers, carbon brushes, carbon collector bows or overhead contact hoops and the like. In such contact devices the metal support or holder is applied and shrunk to the carbon body by a one step or multistep casting operation, using sand casting or chill casting. The connection between the metal support and the carbon is secured in known manner by means of slots, dovetail-shaped recesses, bores, etc., which are filled up by the metal in the casting operation. It has been found, however, that the production of such supports which are cast around the carbon is difficult since the metal on cooling down shrinks or contracts considerably and thereby causes breakage of the carbon by bending or shearing overstress. On the other hand, in order to obtain a good and dense casting, the wall thickness of the metal support has to be made even larger than required with a view to the electrical and mechanical requirements, whereby the shrinking forces acting upon the carbon become very large.

I have now found that these difficulties can be avoided by applying the metal support to the carbon body in an injection moulding or die-casting operation. The amount of contraction of a die-casting is about half the amount only of that of sand or chill casting.

It will thus be understood that in case of an unreduced wall thickness of the metal support the stresses to which the carbon is exposed due to the contraction or shrinkage of the metal casting are only half as much as before. It has been found that this is already sufficient to secure a connection between the carbon and the metal support which is practically free from tension. However, it is even possible to reduce the wall thickness of the metal support in view of the greater strength of die castings as compared to sand or chill casting.

Also the die-casting process permits the production of castings of reduced wall thickness which could not be practically produced in a sand or chill casting process. This reduction of the dimensions of the metal support means a further reduction of the contraction or shrinkage pressures.

Compared to the known Schoop metal spraying process the die casting process offers the advantage that the carbon is tightly gripped or clamped by the die casting due to the shrinkage pressure while in the metal spraying process the metal is merely deposited on the carbon, without exerting any shrinkage pressure at all.

The method and apparatus of the present invention have been described in detail with reference to specific embodiments. It is to be understood, however, that the invention is not limited by such specific reference but is broader in scope and capable of other embodiments than those specifically described.

FRIEDRICH LEUCHS.

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ALIEN PROPERTY CUSTODIAN

AEROPLANE PROVIDED WITH A FIRING TURRET MOUNTED ON A UNIVERSAL JOINT

Pierre Henry Edmond Dufaur de Gavardie, Paris, France; vested in the Alien Property Custodian

Application filed May 14, 1940

The present invention relates to aeroplanes of the type provided with a firing turret mounted on a universal joint.

It has for its object a light and practical embodiment of such a turret and of its mounting on the aeroplane.

It is characterized by the fact that the firing chamber is formed by a squirrel cage and that said cage is rotatably mounted between two cheeks of a U-shaped support having a circular base rotatably mounted in the fuselage of the aeroplane.

By way of example, the preferred embodiment of this invention has been described hereinafter and illustrated in the accompanying drawings in which:

Figs. 1 and 2 show diagrammatically sectional elevations of two forms of construction of a turret arranged at the front of the fuselage.

Fig. 3 shows diagrammatically a sectional elevation of a turret arranged at the rear.

Figs. 4 and 4 respectively show a sectional elevation and a transverse section of a turret arranged at the centre of the fuselage.

Figs. 6 and 7 respectively show a sectional elevation and a transverse section of the turret with its suspension and controlling members.

Figs. 8 and 9 show perspective views of an embodiment of the drum or squirrel cage forming the firing chamber, and of its support.

Figs. 10 and 11 show, on a larger scale, certain details of the controlling and suspension mechanisms.

As shown diagrammatically in Figs. 1 to 5, the turret is formed by a drum 1 which forms the firing chamber and contains the gun and the gunner's seat, said drum being adapted to rotate about its axis, which is arranged transversely with respect to the aeroplane, in a support 2 which is itself adapted to rotate in the fuselage 3 about a longitudinal axis shown diagrammatically by the arrow 4 and parallel with the mean direction of flight of the aeroplane.

The turret according to the invention may be arranged at the front of the aeroplane, in which case the case 2 which surrounds and supports the squirrel-cage shaped drum 1 may, as shown in Fig. 1, be of streamline shape which extends forwards slightly beyond the drum 1. In the case of the embodiment shown in Fig. 2, the case 2 terminates at the front level with the drum 1 by two hemispherical caps which are arranged laterally on either side of the front half of the drum and merge into the contour of same so as to give the front of the fuselage a hemispherical shape which offers a somewhat greater frontal resistance than that of the embodiment of Fig. 1, but is easier to construct. According to Fig. 3, the turret is arranged at the rear in a support 2 which tapers to a point, whereas in the case of Figs. 4 and 5, the turret is arranged at the middle of the fuselage and comprises a drum 1 mounted in a cylindrical support 2 which is held at both its ends in circular brackets secured to the fuselage 3.

As shown in Figs. 6 and 7, the control of the two rotary movements of the turret is effected by means of two cranks 5, 5' which are placed within reach of both hands of the gunner and are journalled in bearings 6, 6' secured to the drum 1 which contains the gun and the gunner's seat. The crank 5, which controls the rotation of the drum 1 about its transverse axis in the support 2, carries a pinion 7 meshing with the internal teeth of a ring gear 8 which is secured to the support 2 and is centered on the axis of the drum. The crank 5', which controls the rotation of the support 2 about the longitudinal axis of the universal joint suspension, actuates, by means of the pinions 9 and 10, a shaft 11 which is so arranged that it can rotate freely along the axis of the drum and which transmits its movement, by means of the two bevel pinions 12, 13, to a longitudinal shaft 16 which is supported in a bearing 17 secured to the support 2 and which carries at its end a pinion 14 meshing with the internal teeth of a ring gear 15 which is fixed on the fuselage and is centered on the axis of rotation of the case 2.

Figs. 8 and 9 show a particularly advantageous method of construction of the turret. The framework of the support (Fig. 8) is formed by a base circle 18 on which are fixed two lateral cheeks 19, 19' which are substantially semi-circular. Inside each cheek there is arranged a circle 20 which is fixed to the corresponding arch 19 and to the base circle 18 by means of spokes such as 21. The rigidity of the assembly is increased by the arrangement of a second circle 22 which is located in a plane parallel with the first and is connected to same by means of braces 25 and held by means of spokes 23, 24. For the sake of greater simplicity, only the two circles 20, 22 of one of the cheeks 19, 19' have been shown in the drawings. The circles, the cheeks and the braces forming this framework are preferably made of metal tubes.

The framework of the drum mounted in the support which has just been described is composed (Fig. 9) of two cheeks which are connected to each other by braces 29 and are each

formed by two concentric circles 26, 27 connected together by spokes 28.

As shown in Figs. 7 and 10, the inner circle 27 of each of the checks of the drum 1 carries two sets of rollers 30, 31, the first of which are mounted on spindles parallel with the axis of rotation of the drum, the others of which are mounted on radial spindles and bear against the ring gear 8 which is fixed on the support and is of Z-shaped cross-section, the peripheral part of which forms an angle and acts as the two orthogonal tracks for the two sets of rollers 30, 31, and the inner part of which is provided at its edge with the teeth with which meshes the pinion 7 of the mechanism for controlling the rotation of the drum.

Similarly, as shown in Figs. 6 and 11, the base circle 18 of the support carries two sets of rollers 38, 39 having respectively radial and longitudinal spindles, whereas the fuselage terminates in a circle 40 on which is fixed the ring gear 15, the U-shaped outer part of which acts as a track for the rollers 38, one of the sides of the U being bent over once at right angles in order to form the track for the rollers 39, then a second time towards the inside of the fuselage in order to form the toothed flange with which the pinion 14 (Fig. 6) of the control mechanism meshes.

The control of the rotation of the drum 1 (or of its support) can be locked by means of the device shown in Fig. 10, which comprises a rod 36 forming a bolt which is provided with a push-button 37 and which slides with friction in the handle 5, which is apertured for this purpose, of the actuating crank. When the push-button is depressed, the free end of the rod 36 penetrates into one of the holes provided in the ring 32 which is secured to the drum, for example fixed on the circle 27, and locks the rotary movement. In order to unlock the control, there has been provided on the handle 5 of the crank a sliding sleeve 33 which is provided with a retracting spring 34 and the movement of which enables the rod 36 to be pushed back to its initial position by acting on the button 37. The stroke of the rod is limited in both directions by a pin 35 which is adapted to move in a longitudinal groove provided in the hollow handle 5.

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JUNE 1, 1943.

BY A. P. C.

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AEROPLANE PROVIDED WITH A FIRING TURRET
MOUNTED ON A UNIVERSAL JOINT
Filed May 14, 1940

Serial No.
335,122

3 Sheets-Sheet 1

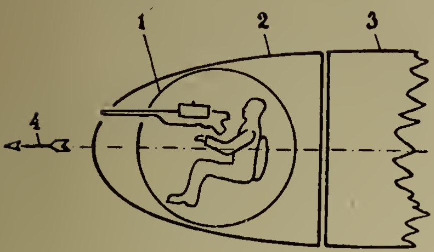

Fig.1.

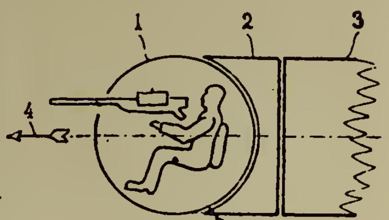

Fig.2.

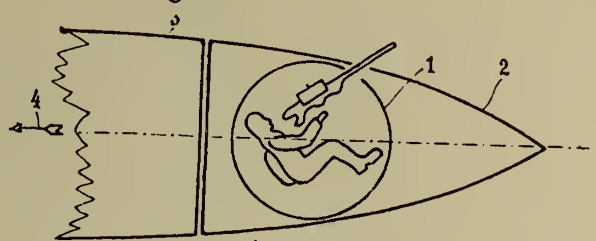

Fig.3.

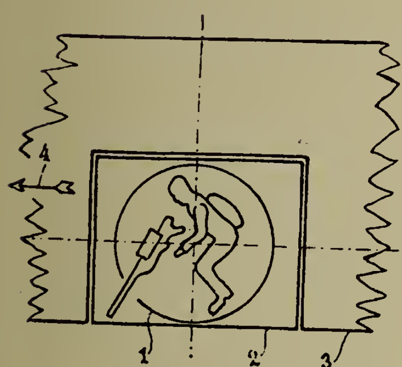

Fig.4

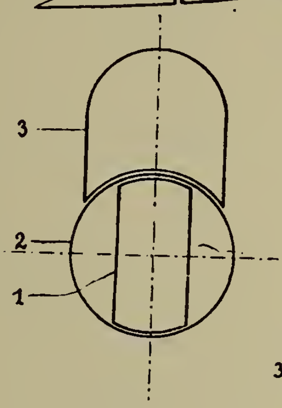

Fig.5.

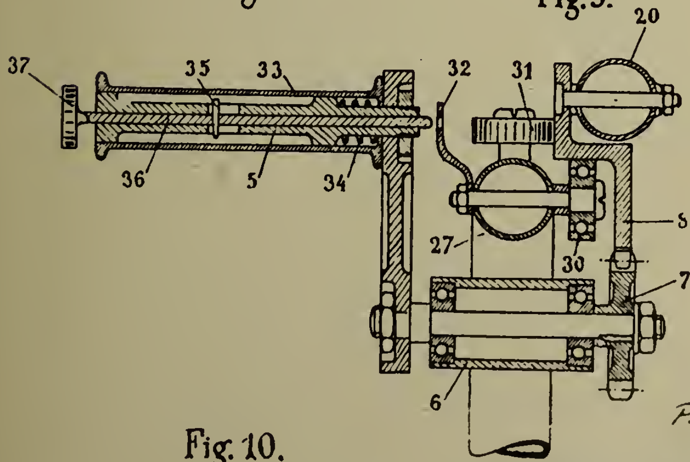

Fig. 10.

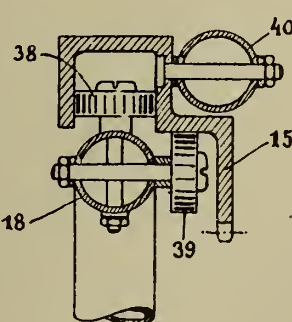

Fig. 11.

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3 Sheets-Sheet 2

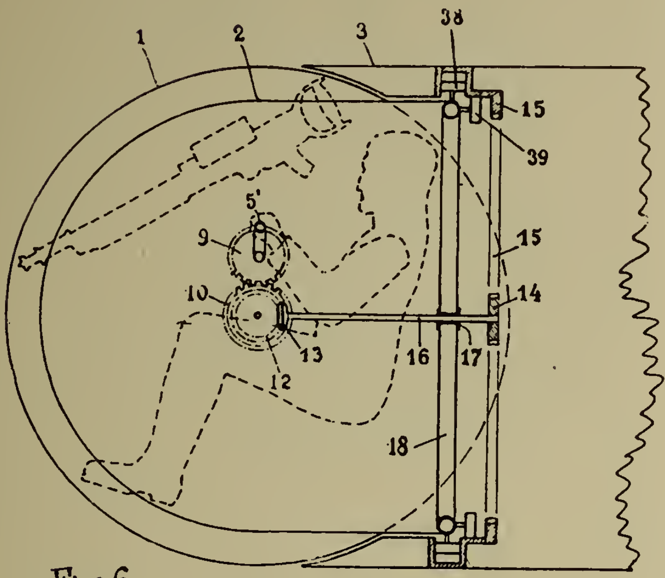

Fig. 6.

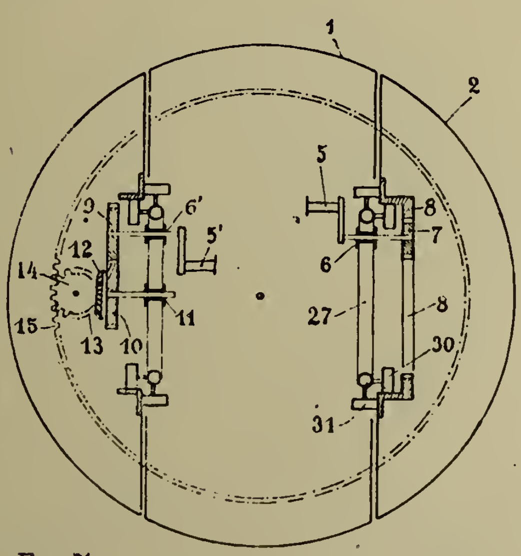

Fig. 7.

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3 Sheets-Sheet 3

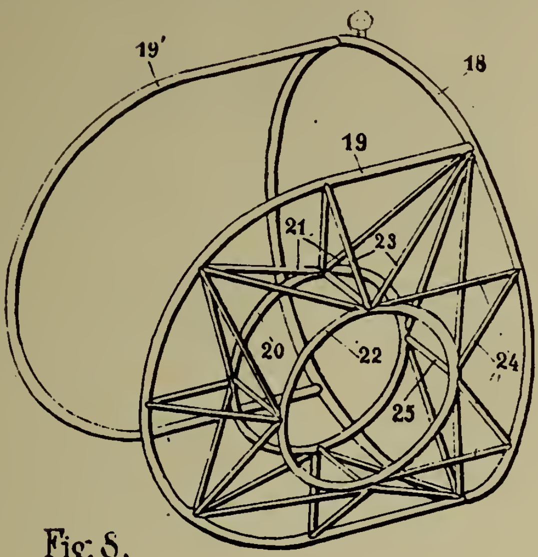

Fig. 8.

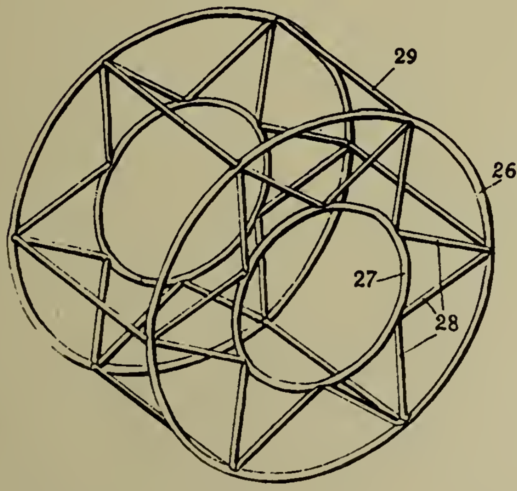

Fig. 9.

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By: Glascock Downing & Seebold
Attys.

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ALIEN PROPERTY CUSTODIAN

PUMPS

Jean Mercier, Neuilly-sur-Seine, France; vested in the Alien Property Custodian

Application filed May 15, 1940

The present invention relates to pumps for liquids, more especially for use on aircrafts, in connection with hydraulic, oleo-pneumatic and similar systems.

The pump with which the present invention is concerned is of the type including parallel pistons actuated by a cam, more particularly as described in my French Patent No. 809,826, filed November 27, 1935.

A pump of this kind includes a plurality of parallel pistons, preferably disposed along generatrices of a circular cylinder, and actuated by means of a rotating cam. This cam is mounted to oscillate with respect to a piece, intended to give it its rotary movement, about an axis perpendicular to the axis of rotation of said cam with respect to said piece. The oscillations of the cam about said axis of rotation are produced, in the direction which tends to reduce the inclination of the cam, by the reaction of the pistons resulting from the action of the liquid that is discharged and of the return springs, and, in the opposed direction, which tends to increase the inclination of the cam, by the action of a sliding push-piece parallel to the axis of revolution, said push-piece bearing against the cam and being subjected to the thrust of an elastic device.

Therefore, this pump ensures an automatic regulation of the discharge pressure, since the inclination of the cam depends upon the value of said pressure. For a given maximum value of this discharge pressure, the cam is at right angles to the axis of revolution and no liquid is any longer discharged by the pump.

In the pumps of the known type, the inlet and outlet conduits or channels were provided at one end of the pump and they were directly connected with the ends of the cylinders containing the pistons. Now, this arrangement, although it gave very satisfactory results under ordinary working conditions, has been found to be insufficient in the case of very high working speeds of the pump, and especially when re-starting a pump which has been stopped for a certain time. This is due to the fact that the space located beyond the pistons ends and which contains the cam is, in this latter case, nearly empty and must be connected, on the one hand, to a special conduit serving to ensure the restarting, and, on the other hand, to the conduits or channels through which the inflow of fluid to the cylinders takes place.

The general object of the present invention is to provide a pump of the type above mentioned which is better adapted to meet the requirements practice than the pumps of the same type made up to this time, and, in particular, which is simpler to construct.

A more specific object of the invention is to provide a pump of this type which eliminates the inconvenience of providing a special re-starting device.

Still another object of the invention is to provide a pump of this type working in a perfectly smooth and regular manner.

According to an essential feature of the present invention, the feed channels or conduits of the pump open directly into the space containing the cam and located beyond the piston heads, and the particular and individual inlet conduits or channels relative to each cylinder respectively open into the peripheral zone of the above mentioned space surrounding the cam.

It will be readily understood that in the case of a very quick rotation of the parts contained in the space surrounding the cam, there is produced, under the effect of the centrifugal force resulting from this rotation, an extra-pressure in the above mentioned peripheral zone. If the cylinders are fed with fluid coming from this zone, two advantages are obtained:

a. First, the feed remains always perfectly regular, and,

b. Re-starting becomes an easy operation, automatically obtained without any special device, owing to the above mentioned pressure, which is established as soon as the parts of the pump are started rotating.

Other features of the present invention will result from the following detailed description of specific embodiments thereof.

A preferred embodiment of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

The only figure is an axial sectional view of a pump of the type above mentioned made according to the invention.

In the embodiment of the invention shown by the drawings, the pump includes a plurality of cylinders **1**, in which are slidably mounted pistons **2** subjected to the action of return springs **3** bearing on the one hand against the block **4** in which the cylinders are provided, and, on the other hand, against pieces **5** belonging to the pistons. These pistons **5** carry the balls **6**, flattened on one side, which bear on a cam **7**. This cam includes two plates **8** and **9**, which are capable of rolling with respect to each other, owing to the provision of ball bearings **10**. Plate **9** is pivoted at **11** to a lateral piece **12**, carried by a

tube 13 which is caused to rotate about the axis of the apparatus by means of any suitable motor, not shown. This tube is mounted on ball bearings 14 and 15.

The space 16 which surrounds the piston heads and cam 7 communicates, through tube or conduit 17 with any suitable supply. The individual feed of each cylinder 1 is obtained through a circular groove or channel 18, provided in block 4 and connected through channels 19 with the ends of the respective cylinders 1.

Channels 20, provided with check valves 21 connect the ends of the respective cylinders 1 with the discharge 22.

The operation of the pump above described is as follows:

As a rule it is identical to that of the pump described in the above mentioned French patent. Tube 13, brought in rotation and driven by any suitable motor, rotates cam 8—9, the inclination of which is variable according to the pressure of the fluid fed by the pump.

The fluid is in space 16, to which it is fed through tube 17. It is driven in rotation and under the effect of the centrifugal force it is expelled into the peripheral zone of space 16 which is in communication with channels or grooves 18. An extra-pressure is produced in the zone in question and it is clear that, under these conditions, cylinders 1 are fed with fluid under a given pressure. Furthermore, when the pump is being restrated after having been stopped for a more or less considerable period of time, the rotation of the elements present in space 16 produces an overpressure in the vicinity of conduits 18, which ensures a correct restarting, which is a very interesting result obtained without any special device.

In view of ensuring a sufficient pressure at the inlet check valves, it is preferable to incline the inlet conduits, taking of course into account the direction of revolution of the pump. Also, I may make these conduits with the shape of blades, especially at the inlet end thereof.

The end portion *7a* of the cam may be made of the shape of the blades of a turbine, which further drives the liquid toward the periphery.

I further provide a supplementary conduit 23, preferably of relatively small section, which connects the zone of overpressure with the ordinary oil or analogous reservoir. This ensures an intensive circulation of the liquid in the casing and increases the evacuation of the calories.

Blades 24 may also be provided on the outer surface of the pump body and they further improve the cooling.

An orifice 25, of small cross section, may be vrovided in the push piece acting on cam 7, so as to deaden the oscillations produced by the reciprocating movement of this push piece.

JEAN MERCIER.

PUBLISHED
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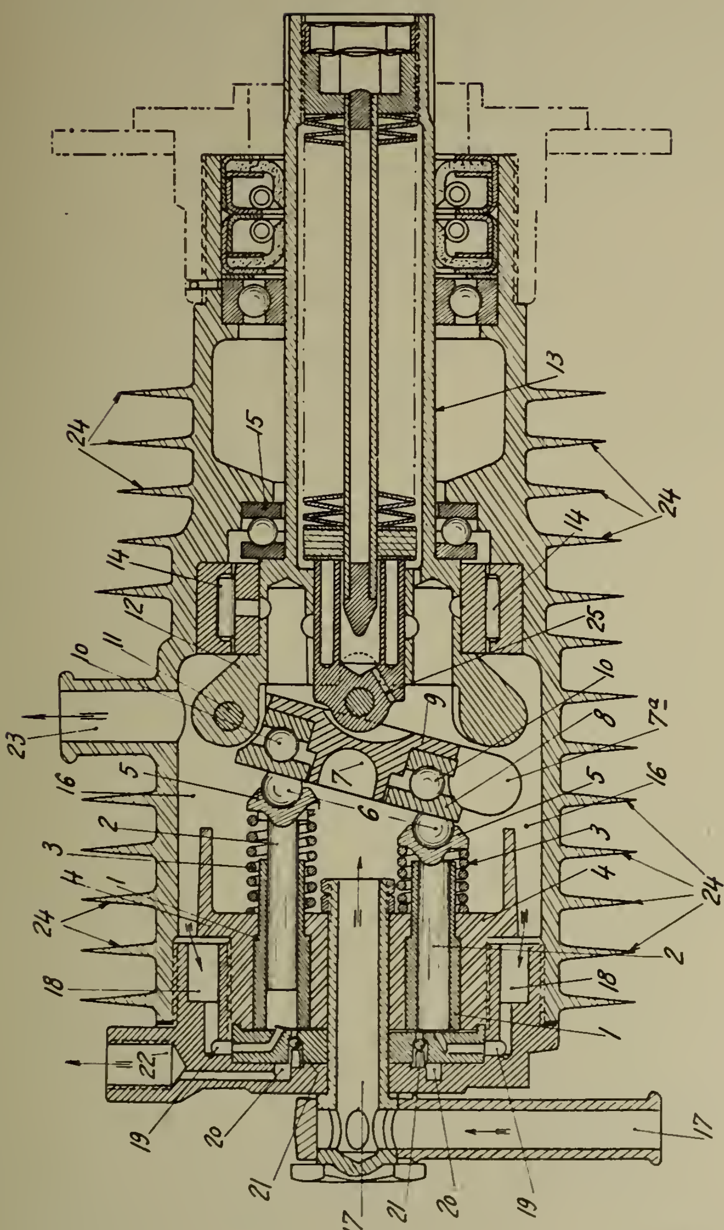
BY A. P. C.

J. MERCIER
PUMPS
Filed May 15, 1940

Serial No.
335,386



Jean Mercier
INVENTOR
By [signature]
his ATT'Y.

Published June 1, 1943 Serial No. 335,398

ALIEN PROPERTY CUSTODIAN

PRODUCTS AND PREPARATIONS FOR THICKENING HYDROCARBONS, PARTICULARLY GASOLINE

Eduard Orno-Ornfeldt, Berlin-Charlottenburg, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 15, 1940

This invention relates to new products and preparations for thickening hydrocarbons, particularly gasoline.

It has heretofore been known to gelatinize or thicken gasoline in order to make it better transportable thereby and to reduce its evaporation speed and explosion tendency.

Hitherto essentially beeswax or an alcohol-soap mixture containing pyridine have been used for the production of solid gasoline. The solidified gasoline, i. e. gasoline in a gelatinized state, however, is extremely sensitive to cold; at degrees far below zero it is decomposed almost completely, quite apart from the further disadvantage that for solidification comparatively dear and little available starting materials are used.

In contrast thereto the present invention consists in heating animal fats and oils containing a large content of unsaturated fatty acids, e. g. fish oils, with mineral oils, particularly lubricating oils, up to temperatures of 150 to 180° C. whilst continually stirring and emulsifying same.

At the cooling procedure stirring is carried on till the mixture gets thickly liquid. The product solidifies; the obtained solid mass is reacted with solvents. The prepared solution is added to that hydrocarbon which is to be rendered more viscous.

Thus according to the invention no gelatinization of the hydrocarbons is obtained at addition of small quantities but the treated hydrocarbon, e. g. gasoline or benzene, becomes first of all highly viscous. At ordinary temperatures the viscosity is approximately as large as that of glycerol or castor oil. According to the invention not only readily volatile hydrocarbons may be rendered more viscous but also middle and heavy mineral oils. The advantages of the invention are to be seen in this that the volatility of the hydrocarbons is very much reduced and that the mixture becomes entirely insensitive to cold, apart from that that, owing to the high viscosity, the transport is considerably facilitated. The traps are no more required as dense as hitherto.

To illustrate the method by which the new thickening substances may be prepared the following example is given, but it should be understood that the invention is not limited to these particulars.

Example

500 g. whale oil and 1 kg. mineral oil, more particularly spindle oil or oil for sewing machines, were mixed together. Then the mixture was heated till boiling and emulsified by stirring. Thereby the mixture first of all became thickly liquid. If thereupon heating was continued up to temperatures of 150 to 180° C., preferably to 160° C., then it became thinly liquid again. As soon as it had become less viscous, heating was interrupted and the mixture was slowly cooled whilst stirring till it was thickly liquid again. Thereupon the mixture was left standing and solidifying without stirring or heating.

The obtained product was solid. It was reduced to small pieces for instance by cutting, and dissolved in a solvent, such as benzene or amyl acetate. To 1 kg. product 2 kg. solvents have been used.

The dissolution takes place very slowly. As soon as it is ended the solution may be added to a hydrocarbon like gasoline. 0,5–1% of the thus obtained solution mixture is added and stirred up to the treated hydrocarbon under heating. At ordinary temperatures the thus prepared gasoline is as viscous as glycerol or castor oil. Dependent upon the quantity of added constituents the viscosity of the gasoline may be obtained variable.

EDUARD ORNO-ORNFELDT.

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ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF ENAMELS

Maxime Paquet, Saint-Maur-des-Fosses, France; vested in the Alien Property Custodian

No Drawing. Application filed May 16, 1940

Enamels having a very high covering power, known as super-opaque enamels, have already been manufactured. Such enamels when applied to a black body in a layer of about 350 grs. per sq. m. provide surfaces which diffuse light to the extent of 70–75%.

Hitherto, it has been possible to obtain such enamels only by adding to each grinding mixture considerable quantities, for example 8–16%, of an ordinary opacifying agent (tin oxide, zirconium oxide, antimoniates etc.) to the frits (granular material) already rendered very opaque on fusion by considerable quantities of antimony compounds. On analysis, said granular material or frits usually show Sb_2O_5 contents of 11–13%.

Hitherto it has been impossible to obtain such enamels with a very high covering power free from antimony since in the best frits free from this opacifying agent it has been necessary to add to the grinding mixture 15–20% or more of ordinary opacifying agents (tin oxide, zirconium oxide, antimoniates, etc.) in order to obtain the opacity and covering power indicated above.

Under these conditions the enamel became hard and porous. Its resistance to friction was greatly endangered and its brilliancy very much reduced to the point of being no longer appreciable. In short, the enamel lost a part of its principal properties.

We have found that if quantities of cerium oxide of from 4–7% are added to a good frit which is capable of properly developing said opacifying agent, that is to say, one which is sufficiently aluminous, and if care is taken prop-e y to disperse said opacifying agent by means of a prolonged grinding operation, the enamel obtained, when applied to a black body in a layer of 350 grs. per sq. m., easily provides surfaces which diffuse light to the extent of 72–75%. Th's enamel possesses besides a high covering power a remarkable brilliance and the cerium oxide improves its principal properties and physical qualities.

The present invention consists in a process for the manufacture of very opaque enamels consisting in grinding the frit, an opacifying agent or a mixture of opacifying agents containing cerium oxide and clay, to a high degree of dispersion; preferably the grinding will be carried out so that a mixture containing the cerium oxide and the frit, passes through a 325 sieve with not substantially more than 1% retained on the sieve, this mixture being capable of use directly or after the addition of less finely ground mixtures.

Grinding can be carried out more particularly according to the following two methods:

1—The frit plus the opacifying agents and clay may be ground very finely so that the whole passes through a 325 sieve, not more than 1% being retained on the sieve; or

2—25–50% of the frit may be ground very finely with the cerium oxide and the clay so that the whole passes through a 325 sieve, none of the mixture or at the most 1% being retained on the sieve. The remainder of the frit, namely 75–50% and the necessary water are then added and the whole is then ground according to the usual methods so that it passes through a 200 sieve with a maximum of 1–2% retained on the sieve.

This second method gives enamels which can be applied without difficulty and without special precautions like ordinary enamels, while the first method requires a few particular precautions during application.

Our process has the advantage of permitting:

(*a*) the production of super-opaque enamels by the simple of cerium oxide to the grinding mixture;

(*b*) the production of super-opaque enamels with frits which may be those usually employed in ordinary enamels in which cerium oxide is used as an opacifying agent, provided the frits properly develop the opacity of these substances;

(*c*) the production of super-opaque enamels using transparent frits or frits which have only been previously rendered opaque by fluorides to the exclusion of compounds of antimony;

(*d*) the production of super-opaque enamels which are free from antimony and which are consequently non-toxic and capable of use for enamelling domestic articles;

(*e*) the production of very brilliant non-porous super-opaque enamels which have a high resistance to friction;

(*f*) the production of enamels for domestic articles which enamels can be used in very thin layers and which therefore have a very high resistance to thermal shocks due to sudden changes of temperature.

By way of example and in order to facilitate the understanding of the description we explain below one way in which the invention can be carried out in practice:

The frit is first prepared using one of the following compositions A, B or C or a similar frit; all frits which are capable of properly developing the opacifying properties of cerium oxide can likewise be used without inconvenience. Frits

rendered opaque by one or more fluorides are particularly suitable:

	A	B	C
Feldspar	350	360	460
Quartz	60	100	50
Kaolin	125	130	100
Ordinary borax	210	210	220
Sodium carbonate	70	65	100
Sodium fluosilicate	125	130	100
Fluorspar	----	----	40
Magnesia	10	10	15
Sodium nitrate	50	40	20
Ground zircon	25	30	40

The grinding of said frit with cerium oxide to which, if desired, other opacifying agents may have been added, is then carried out. When cerium oxide is used as the only opacifying agent the proportions are 4–7% of the total weight of the mixture constituting the enamel, the proportion of 6% giving good results. When it is used together with other opacifying agents such as zirconium oxide, oxide of tin or antimoniates, the proportion of cerium oxide may be lowered to 3%.

The following examples of grinding mixtures have given good-results:

No. 1 grinding

Frit A or other frits	100
Clay	6
Cerium oxide	6 (4–7)
Magnesium carbonate	0. 3–0. 5
Water cc	60

The whole is ground until a maximum of 1% is retained on a 325 sieve.

No. 2 grinding

Frit A or other frit	35
Clay	6
Cerium oxide	6 (4–7)
Magnesium carbonate	0. 3–0. 5
Water cc	30

The whole is ground until it passes completely through a 325 sieve.

Then add to the previous grinding:

Frit A or other frit	65
Water cc	30

Grind until a maximum of 2% is retained on a 200 sieve.

No. 3 grinding

Frit A or other frit	35
Clay	6
Cerium oxide	3–5
Zirconium oxide	5–8
Magnesium carbonate	0. 3–0. 5
Water cc	30

The whole is ground until it completely passes through a 325 sieve.

Then add to the previous grinding:

Frit A or other frit	65
Water cc	30

Grind until 2% at the most is retained on a 200 sieve.

When applied to ordinary black articles in layers of 350 grs. per sq. m. these enamels yield very brilliant and very white surfaces which diffuse light to the extent of 72–74%.

His
MAXIME × PAQUET.
Mark

Published June 1, 1943

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ALIEN PROPERTY CUSTODIAN

SHIPS' DAVITS OF THE GRAVITY TYPE

Ane P. Schat, Utrecht, Netherlands; vested in the Alien Property Custodian

Application filed May 16, 1940

My present invention relates to ships' davits of the gravity type, i. e. to davits comprising a davit arm adapted to travel down an outwardly sloping track disposed substantially athwartships on the vessel and thereby to move from an inboard position into an outboard position exclusively under the influence of gravity. In certain types of gravity davit, the davit arm has its foot pivoted to a carriage adapted to run on the track and is thus adapted for outward swinging or luffing movement in addition to outward traveling movement, reference being had to my prior U. S. Patent Serial No. 1,141,452.

As to said track, it is desirable for the same to have a steep inclination, in order that the boat may be readily launched even on the high side of a ship having a heavy list. On the other hand, a steep inclination of the track means increased height of the boat above the water line and consequently, apart from other drawbacks, reduced stability of the ship.

The primary object of my present invention is a gravity davit by means of which the boat can be safely and quickly launched under practically all conditions and nevertheless be stowed at a relatively low level. With this and other objects in view, I suggest to provide for means whereby the slope of the davit arm track relative to the ships' deck can be varied, preferably by pivoting the outer end portion of the track to the ship so as to adapt it for transverse swinging movement, and by associating the inner end portion thereof to the ship by a telescopic screw gear such, for instance, as disclosed by my prior U. S. Patent 2,044,403.

In order that my invention may be fully understood, I shall now proceed to describe the same with reference to the annexed more or less diagrammatic drawing, on which:

Fig. 1 is a front view of a life boat suspended from a gravity davit in accordance with my invention, the inboard or stowed position being shown in full lines, two outboard positions being indicated in dotted lines, and

Fig. 2 is a similar front view of a somewhat different arrangement.

In Fig. 1, the reference numeral 5 (5') designates the life boat, 6 (6') one of the two boat falls, and 7 the corresponding davit arm. The davit arm as an enlarged foot provided with rollers 8, through which it is adapted to run athwartships on an outwardly sloping track 9. Said arm is thus capable, exclusively under the action of gravity, to travel from its inboard position to its extreme outboard position.

Detachably secured to the boat are a pair of skates 10 (10'), which serve for protecting the boat against damage during lowering and for guiding it over the ship's side, as is well known in the art.

In accordance with my invention, the track 9, instead of being rigidly secured to the vessel such as is the case in prior suggestions, is pivoted with its outer end to the deck 12 as at 11, whereas its inner end portion is associated with the ship through a telescopic screw gear 14 hinged both to the deck and to the track, and adapted to be actuated by means of a crank handle 13.

Assuming the ship to have an appreciable list and the boat illustrated to be on the high side thereof, the slope of the track 9 in its lower position, as indicated by full lines, may be so small as not to allow the davit arm 7 with the boat 5 suspended therefrom to move outward by gravity only. In that case all that is required is increasing the slope of the track 9 by turning the crank handle 13 until the screw gear 14 has forced the track into a position wherein the slope of the latter is steep enough for causing the davit arm with the parts associated therewith to travel towards the water.

In its normal or lower position the track 9 has a slope, which just allows the boat to move outward by gravity on the high side of a ship having a list of say 10°. With this relatively small slope, the stowed boat may be arranged to assume a position only slightly above the deck 12.

The distance through which, in the extreme outboard position of the davit arm 7 on its track 9, the davit head projects laterally from the ship's side increases with the slope of the track. This clearly follows from Fig. 1 of the drawing, which shows that with the track 9 in its normal or lower position and in the position indicated by dotted lines the davit arm will assume positions A and B, respectively. The drawing further shows that with the davit arm in position A, the aforesaid distance is smaller than half the width of the boat 5. Consequently, the boat is preferably lowered in this position of the davit, in order that it may remain pressed against the ship's side and thus be prevented from swaying movement during the paying out of the falls. However, when the boat is to be hoisted again, the slope of track 9 should be increased, so that the davit arm approximately assumes position B, whereby the boat during hoisting will clear the ship's side.

According to Fig. 2, the track 9 is mounted at a level as to provide for a passageway between it and the deck 12. In said figure, like parts are designated by the same reference numerals as in Fig. 1.

ANE P. SCHAT.

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JUNE 1, 1943.
BY A. P. C.

A. P. SCHAT
SHIPS' DAVITS OF THE GRAVITY TYPE
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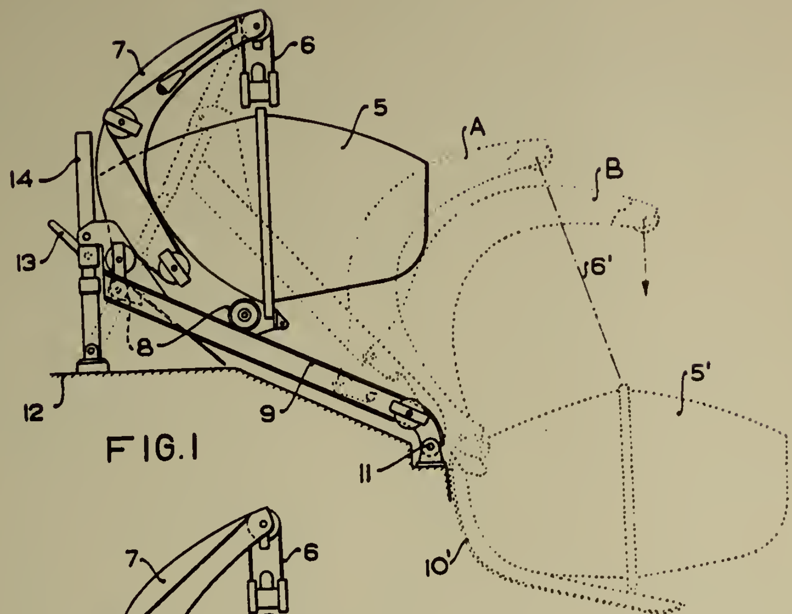

FIG.1

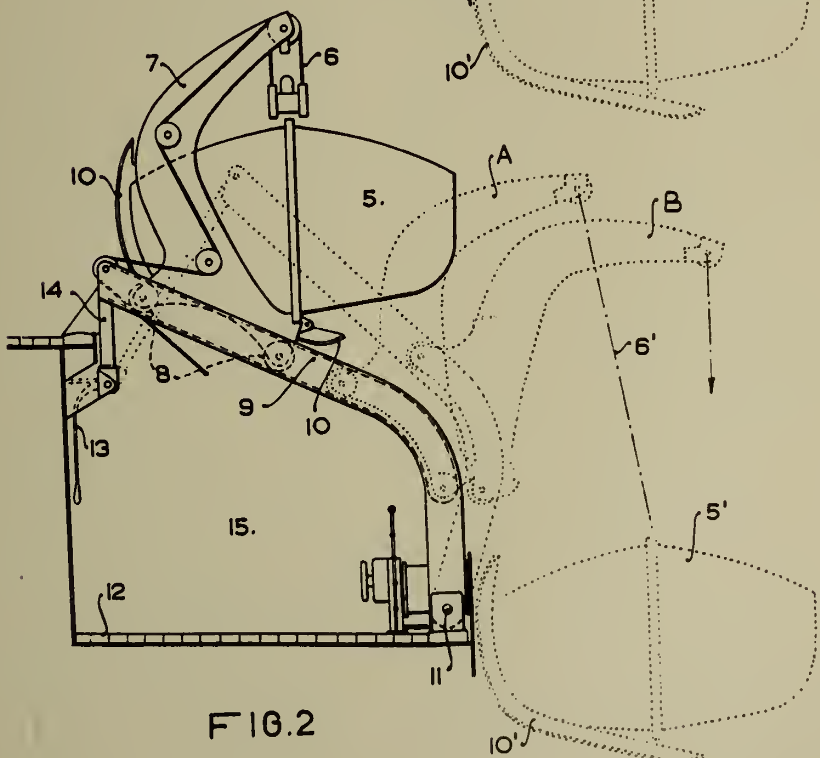

FIG.2

Inventor,
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Attys.

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ALIEN PROPERTY CUSTODIAN

METHOD OF MAKING SIGN-PANELS

Václav Vürbs, Krhova-Hradky, Bohemia-Moravia; vested in the Alien Property Custodian

No Drawing. Application filed May 21, 1940

This invention relates to sign-panels of the type having light-reflecting areas provided thereon, as for instance warning or orientation sign-panels, way indicators and the like, such as are used alongside of roads to mark railway or road crossings, serpentine road sections and the like. Heretofore sign-panels of this type have been made by a method in which the light-reflecting layers in the form of signs or letters are caused to adhere to the lacquer coated face of the panel before the lacquer coating has time to harden and then, when this backing coating has hardened, the whole of the panel together with the reflecting layer is provided wtih a transparent covering layer cf paint for protection against atmospheric agents. The object of the invention is to secure, by a particular method of manufacturing sign-panels of the above described type, a perfect adhesion of the lacquer layers as well as of the light-reflecting areas and of the paint coating on the same, a permanent reflection effect and a resistance as great as possible against atmospheric influences. According to the invention these desired results are obtained by the use as a light reflecting surface of finely corrugated metal foil, preferably an aluminium foil. The expression "finely corrugated foil" is used in the body of the specification and in the claims to describe particularly an irregularly wrinkled flat foil whose folds, extending in all directions and considerably varying in length, form "waves" which on their sides reflect light in all directions. By corrugating the metal foil perfect reflection of light in all directions is obtained and moreover intimate union of the foil with the lacquer backing and the covering coating is secured. Advantageously the foil is provided with fine fissures or perforations preferably after it has been secured to the backing lacquer layer. Thus evaporation of the lacquer solvent is permitted during the hardening of the backing layer also within the areas under the applied foil and the formation of bubbles and bumps on the face of the metal foil is prevented, and moreover the aforementioned fissures or perforations insure a strong bond between the covering and backing lacquer layers, thereby increasing the strength and durability of the sign-panel.

As metal foils there is made use of very thin aluminium, tin or other metal foils which are first finely corrugated or wrinkled in such a manner as to have the appearance of a crumpled leaf which, however, is substantially flat. Alternatively it is possible to cut out the metal foil to a larger size than that of the surface to be covered by the same and then cause the foil to adhere by its margins on the still sticky surface to be covered in such a way that the portion of the foil between such margins becomes arcuate, thereafter pressing the foil against the lacquer backing, for instance, by means of a rubber roller, whereby the whole inner surface of the metal foil becomes corrugated, the corrugations extending in all directions without projecting above the plane of the foil so that the finished sign-panel is perfectly smooth.

In the practical working of the method according to the invention the panel to be treated, e. g. a sheet of metal, is cleaned, if desired by sand blasting, so as to insure reliable adhesion of the lacquer coating on the surface of the panel. The lacquer backing is formed preferably with a synthetic resin lacquer. Preferably a lacquer is used which must be heated to a certain temperature in order to harden, e. g. a synthetic resin lacquer which does not change its colour at a temperature of between about 120° C. and 140° C. This lacquer is applied on the panel, e. g. by spraying, and then the panel is caused to dry, preferably by heating to a comparatively low temperature, e. g. to 60° C. during a period of ten minutes. After such heating the lacquer coating is still sufficiently sticky. The sign, letter or the like, which is cut out from an aluminium, tin or other metal foil, is then applied on this coating and adheres to the same. The signs or letters are cut about one third larger in size than their desired size on the panel. Before its application, or during such application, the foil is so corrugated as to reduce the design to the required size, so that when the foil is forced down completely on the lacquer backing, e. g. by means of a rubber roller, fine protuberances are formed on the surface of the foil and the latter is completely pressed down flush with the plane of the panel. In this way irregular protuberances and wrinkles extending in all directions arise in the foil, such protuberances and wrinkles reflecting the light in all directions. The stuck-on foil is provided with fine fissures which are obtained either by interrupting the crests of the corrugations at certain points, or by perforation by means of a metallic brush or the like. Then the pancls are placed in a furnace heated to about 120–140° C. where they are left for a comparatively long period, e. g. 1–2 hours. By this burning the backing lacquer hardens on the panels. After removal from the furnace and cooling down the panels are provided with an opaque covering paint which covers the edges of the foil

and delimits the reflecting foil areas exactly to the desired shape. The opaque covering lacquer also prevents the edges of the foils from becoming loosened and fringed. After application of the covering paint, which may be black, blue or of any colour, the panels are allowed to dry somewhat and then are again burnt in a furnace at a temperature of about 120 to 140° C. After removal from the furnace and cooling the panels are provided, e. g. by spraying, with a protective layer of a colourless lacquer of the same composition as that of the backing layer, e. g. a synthetic resin lacquer. Through the fissures of the foils this lacquer layer becomes intimately united with the backing lacquer layer so that it cannot be loosened by the atmospheric agents. When the insulating lacquer has been sprayed on the panels the latter are once more allowed to dry somewhat and then are subjected to drying in a furnace at a comparatively low temperature, e. g. 80° C. for about half an hour, whereafter the panels are left to dry completely at room temperature.

The described method also permits to provide reflecting areas on panels on which it is then possible to paint the desired signs, letters or the like by means of opaque lacquers. Before the application of the final protective layer the foil may be provided wtih a transparent coloured lacquer layer, e. g. a yellow layer, so that the metal foil will have a golden aspect.

Most advantageously an aluminium foil is used in carrying out the improved method, as such foil insures to the highest degree constant light-reflecting characteristics even after a prolonged exposure to the atmospheric agents.

VÁCLAV VÜRBS.

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Serial No. 337,084

ALIEN PROPERTY CUSTODIAN

LIMB (GUARD OR) PROTECTOR FOR THE SPORTSMAN AGAINST STROKES OR THE LIKE

Virgilio Giardini, Milano, Italy; vested in the Alien Property Custodian

Application filed May 24, 1940

During the sport games it is advisable or necessary for the players to wear a shield in order to avoid the consequence of strokes or shocks on the limbs. Such a shield may also be sometimes advisable for workers to prevent accidents or the like.

For the purpose were proposed different apparatuses to smother the effect of strokes or shocks, particularly on the shin-bone, among which are to be considered the pads of elastic material such as felt, rubber, stuffing or pneumatic cushion. Such pads cannot constitute a shield offering a sure protection, therefore stiffening inserts were used in such pads. With the stiffening inserts there is an improvement compared to the pads without inserts, nevertheless the pads with stiffening inserts do not offer the best solution on account of the fact that the affected surface of the limb is greater than that covered by a mere pad, where the effect of the stroke is distributed on a surface a little larger of that of the two stroking bodies. Anyhow the interested surface is always, more or less, restricted around the stroked zone.

In order to avoid the effect of the stroke only on a restricted surface, according to the invention, the limb protector makes use of a stiff gutter-shaped part, which do not contact directly with the limb. The limb is bandaged with a flexible and not yielding material, which constitutes a bridge between the lateral edges of the gutter so that a void space results between the bandage and the gutter.

It is a matter of course, therefore, that a stroke on the gutter will affect a large surface, which will comprehend at least a good part of the breadth and all the length of the bridge.

In order to make clearly understand the present inventon, on the annexed drawing there is schematically presented one form of the invention in the shape of a shin-bone protector, that is in:

Fig. 1 a back view, in

Fig. 2 a front view, in

Fig. 3 a side section and in

Fig. 4 a view from the height of a shin-bone protector according to the present invention.

In all figures the same part is marked with the same reference.

The gutter *a* is constituted of a material suited for the purpose, that is of sufficient stiffness and resistance to strokes, such as f. inst. hard-rubberized or resin impregnated fabric, hard rubber incorporating textile fibres, metal sheet, fibre, or the like, and presents a noteworthy bend. The edges *b* are properly rounded in order to avoid the tearing of the bandage *d* on the jointing lines on which both contact. If the case requires the gutter may be provided with stiffening ribs *c*, of suitable size and shape, which can show either a transverse or longitudinal or any other direction.

The bandage *d* is attached to the gutter *a* along the edges *b* and to the leg by means of the straps *e*. The material employed for the bandage has on the one hand to be flexible enough to fit properly to the leg and on the other to be enough inextensible in order to resist to the strokes and to the flattening tendency of the gutter without stretching out and so let the gutter stroke the shin-bone.

On account of the fact that the limb protector has to guard the bones more than the fleshy part of the limb, it is a matter of course that the attaching means have to be such to correspond entirely to this requirement.

In the example is necessarily described only a given type of limb protector, that is a shin-bone protector. It is a matter of course that the basic idea of the present invention may be employed for the protection of other limbs as f. inst. the forearm and be so shaped as to protect either the cubital or the radial bone or both according to the probability of the one or the other to be struck or hurt.

On the illustrated example the limb protector is fixed to the leg by means of straps, but evidently the fixing means vary as f. inst. the shin-bone protector can be fixed to the stocking of the wearer or the material used for the bridge may extend so as to bandage the leg and be tightened by strings or by zipper fastening or by other means suitable for the purpose.

In some cases it may appear suitable to provide the side toward the wearer limb of the material of the bridge or of the whole bandage and the straps with a lining such as felt, sponge rubber, sheets of rubber coated hair, a. s. o. in order to further absorb the stroke and particularly to allow a free movement of the muscles. The space between the gutter and the bridge may be closed at the ends by means of the same material used for the bandage or for the lining or any other suitable material.

The shape of the gutter can vary according to the different requirements without leaving the basic idea of the invention. It may assume more or less the form of the limb so that f. inst. the shin-bone protector may be worn underneath the stocking without being too much noticed.

Should it be required a gutter of great stiffness, some well disposed stiffening ribs will do.

It results from the before said exposition that the basic idea can be further developed in order to suit the requirements of its employment in the different cases or in order to reach the shape which better suits the aimed scope.

VIRGILIO GIARDINI.

PUBLISHED

JUNE 1, 1943.

BY A. P. C.

V. GIARDINI

LIMB (GUARD OR) PROTECTOR FOR THE SPORTSMAN AGAINST STROKES OR THE LIKE

Filed May 24, 1940

Serial No. 337,084

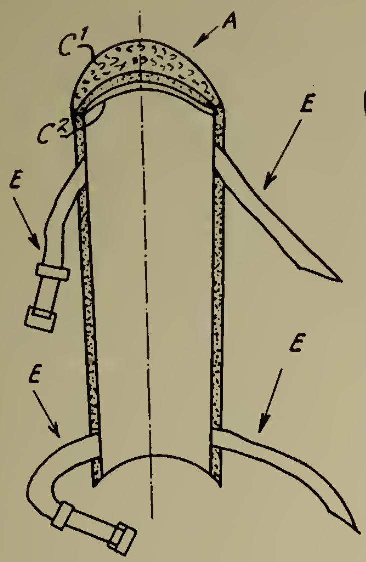

Fig.1

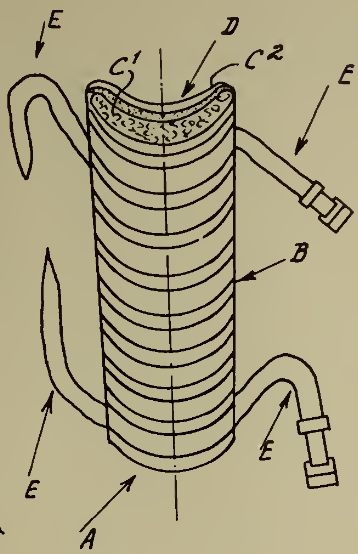

Fig.2

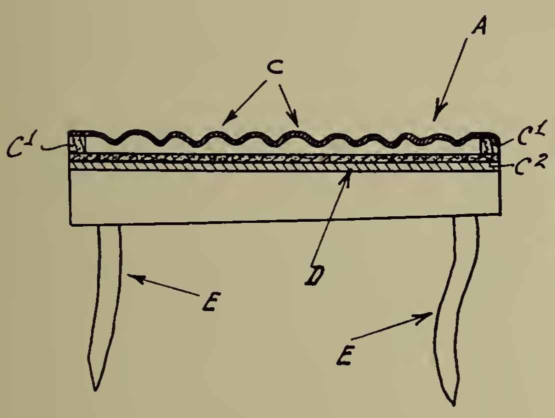

Fig.3

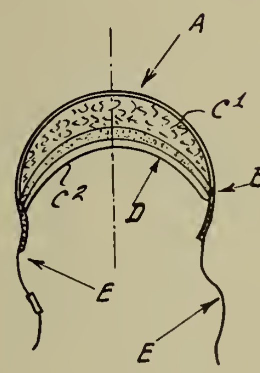

Fig.4

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ALIEN PROPERTY CUSTODIAN

METHOD OF DEVELOPING PHOTOGRAPHIC METAL SALT LAYERS

Johannes Rzymkowski, Jena, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 31, 1940

The present invention relates to a method of developing photographic metal salt layers in which oxidation-reduction systems are used as developers the reduction potential of which is electrolytically influenced during development.

It is well known that, when using irreversibly reacting developers, the halogen ions may be removed by electrolysis by oxidizing them at the anode and by chemically binding them by the material of the anode. If for instance the anode consists of silver, silver halide is formed at the anode. In a cyclic process the halogenated anode is then again electrolyzed in an alkali solution by making the anode the cathode, whereby the former looses halogen. It has, however, not yet been thought of combining the anodic process of separation of foreign ions with the cathode process which permanently reduces oxidation-reduction systems and in this manner continuously maintains the reduction potential of said systems.

In carrying out the method according to the invention the well known operating methods employed in the electrochemistry are used. The anode which is used to bind the foreign ions is arranged either in the same space as the cathode or is separated from the catholyte by a diaphragm. In both cases the anode, used for removing halogen ions from silver, may consist of thallium, lead or silver coated wire mesh. Eventually the anode is coated with a conducting colloid, for instance by gelatinizing the anode by dipping same into a 5% gelatine solution mixed with a conducting salt.

During the electrolysis of a system containing potassium bromide the formation of silver bromide at a silver anode either may be due to the fact, that the atomic bromide formed at the anode reacts with the silver electrode, or that the silver is dissolved by anodic polarisation and converts with the bromide ions present in the neighborhood.

This mode of operation of removing foreign ions may be used for developing photographic silver halide layers by a method in which adsorptive oxidation-reduction systems are employed as developers.

As suitable oxidation-reduction systems the following may be mentioned by way of example: anthraquinones, phenanthraquinones, indophenols, aminoindophenols, indamines, thiazines, oxazines, saffranines, rosindulines, rosindones and viologenes, but also conjugated systems with open chains, such as iso-vitamin C, heterocycles such as indigo derivatives, organic complexes of the type $Alk_x[(R.COO)_yMe_z]$. Examples of such organic complexes are the ferric complexes with citrates. These oxidation-reduction systems constitute a mixture of the oxidation and reduction products, the designation of the oxidation-reduction systems always being effected according to the oxidized form. When using such an oxidation-reduction system as developer, the reduction potential desired in each particular case, which, of course, can be altered from case to case, is electrolytically adjusted. If, for example, it is desired to maintain the reduction potential at a constant value during the development, in order thus also to obtain a constant γ in the developed silver halide layer, the developer is in each particular case reduced by the electrolysis in the degree in which it is oxidized. The usable oxidation-reduction systems must be adsorbed upon the silver halide grains or latent image. Furthermore, it is advisable to use only those oxidation-reduction systems which yield a constant potential. As experience shows, this is best ensured in the fields which do not lie within the range of the over-voltage of the hydrogen or oxygen. It is possible to undertake the development at the potential at which the development works free from fog and with large γ-values. Since the electrode potential of reversible oxidation-reduction systems often depends upon the pH-value, as, for example, in the case of anthraquinone or indigo derivatives, it is advisable in such cases to maintain constant the actual hydrogen-ion concentration, which can be accomplished either by the addition of buffer systems, such as acetic acid-sodium acetate mixtures, borax-boracic acid mixtures or, alternatively, by blowing-in of carbonic acid, adding drops of acid, or by means of neutralisation anodes and the like. Such a mode of working is furthermore indicated particularly when the electrodes are not arranged in the developing vessel. When a diaphragm is used, the passage of current liberates hydroxyl ions of the water at the cathode and additions are necessary to maintain the pH-value of the developer solutions. This maintenance of the reduction potential at a constant value, on the one hand, by the electrolytic influencing and on the other, by the maintaining constant of the pH-value, would not produce any suitable developer liquids within the ranges of the hydrogen or oxygen over-potential since, as experience shows, in these ranges, the potentials set in only badly or very slowly. During the photographic development of silver halide, halogen ions become free. Although the potential of the oxidation-

reduction system is not influenced thereby, the effectiveness of the developer would nevertheless vary in the event of an enrichment of these ions in the developer.

Of course, such a method when carried out is not limited to the development of silver halide layers. For the purpose of the invention it is of importance only that adsorptive oxidation-reduction systems are used the reduction potential of which is electrolytically influenced during the development, whereby the foreign ions occurring are bound at the anodes. In an ideal manner, therefore, the action of the cathode as well as that of the anode are most favorably utilized in the same period of time during the electric development, i. e. the cathode reduces the oxidation-reduction system, whereas the anode oxidizes and binds the foreign ions. Of course, this mode of operation fundamentally may be carried out in any manner. So for instance it is possible to operate in such a manner, that the potential of the oxidation-reduction system,—the usable oxidation-reduction system must, as has already been indicated above, be absorbed upon the metal salt grains or latent image—lies between that of the hydrogen electrode and that of the oxygen electrode. The concentration of hydrogen ions may be maintained constant during the development.

The devices used for carrying out the method generally are employed in the electrochemistry. For instance, the cathode and anode may be provided in spaces separated from each other which, however, are electrically connected to each other. The developing liquid, for instance, forms the catholyte, whereas the foreign ions reach the anolyte and are rendered harmless at the anode. The electrolysis also may be carried out by means of electrodes of medium or high overpotential and/or by the use of intermediate bodies or catalysts. Finally, this method also may be used in connection with the color photography by reducing water soluble oxidation-reduction systems, for instance dyestuff, to water soluble leuco stages and bathing in these photographic metal salt layers. In a manner known per se, either the dyestuff or the reduced metal is removed from the developed images and finally emulsions with separated layers known per se are treated in this manner to obtain natural color images.

To facilitate the separation of foreign ions at the anode eventually and preferably latest images of photographic metal salt layers are developed by such oxidation-reduction systems which are effective at a pH-value equal or smaller than 7. Should an oxidation-reduction system develop at a higher pH-value only, then the anolyte is separated from the catholyte by a diaphragm and the anolyte is adjusted to a pH-value equal to or smaller than 7.

With the method described above a cyclic process also is carried out, for instance by passing the matter to be developed successively through a plurality of electrolyzers arranged side by side. Or the solution together with the oxidation-reduction system or systems is successively and alternately passed either through the cathode space of an electrolyzer for adjusting the proper reduction potential, then over the material to be developed and finally for the purpose of depositing the foreign ions is passed through the anode space of an electrolyzer the anode of which, consisting for instance silver, binds the foreign ions.

In this manner the reduction potential of the oxidation-reduction system is permanently maintained, particularly if the pH-value is properly maintained at the same value, and a uniform removal of the halogen ions in excess.

In the pauses or stops occurring in the above described cycle of the oxidation-reduction system, the anode of the electrolyzer is chemically and electrolytically regenerated.

Practical example

A developing vessel for film strips is filled with 100 litres of a 1% solution of β-anthraquinone sodium sulphonate the pH-value of which for the development of a negative emulsion, preferably consisting of silver bromide, is adjusted by buffering by means of acetic acid sodium acetate within the range of pH4 to pH5. Immersed in the developing vessel are two electrodes at a distance apart of 150 mms. One of the electrodes, the cathode consists of graphite, whereas the anode is formed as a revolving disc-like silver wire mesh. Mercury also is suitable as cathode material. For carrying out the electrolysis a potential of 2–8 Volt is recommended. Immediately after the application of the potential difference, the β-anthraquinone sodium suphonate is reduced in the vicinity of the cathode to the green anthrahydroquinone. The reduction is continued until a substantial equimolecular mixture of the anthraquinone and anthrahydroquinone stages is obtained. For the purpose of ensuring a good current output, the current density at the cathode being chosen so high that no visible bubbles of hydrogen arise. This condition may for example easily be determined colorimetrically and potentiometrically in a well known manner. The film strip is then introduced into the now finished developer and the current density is moderated to such an extent that the equimolecular ratio is substantially maintained throughout the development. This may entirely automatically be carried out if photo-cells are used for the colorimetric control which cells in turn control the electrolyzing current. This control also may be effected potentiometrically by means of so-called auxiliary electrodes. In this manner many kilometres of picture-or sound strips respectively may be developed in the same developing bath without a fluctuation occuring in the γ-value of the developed film.

The halogen ions introduced by the negative emulsion are continuously oxidized at the silver anode and nearly quantitatively separated as silver halide particularly at low current density, for instance a density of 0.006 ampere/cm^2 or more of the anode surface. It is, however, advisable eventually to reduce the current density during electrolysis.

If, after interruption of the current, the silver halide formed does not automatically drop into a hole below the anode then the halogenated anode either is treated electrolytically in a 1-n- sulphate or alcaline bath by employing said anode as cathode in a second electrolyzer, whereby the halogens are dissolved from the silver cathode and are introduced into the electrolyte which either may be thrown away or be regenerated to halogens, or the halogenated surface is dissolved in a special vessel in a solvent capable of dissolving silver halide salts, for instance potassium cyanide, ammonia or mainly thio-sulphate or the like, whereupon the anode metal dissolved is chemically or electrolytically deposited.

If thin silver-plated wire meshes are used as anodes the latter are, after removal of the silver

halide, again and again electrolytically silver-plated in an ammoniacal silver oxalate solution.

As in large copying works spent fixing baths are electrolytically regenerated to silver, the regeneration of the anode material according to the present invention causes no loss of time, as the above mentioned solution simply is combined with old spent fixing baths to be commonly electrolytically regenerated.

It is, however, more comfortable to place the silver anode in contact with some aluminium in a salt solution or to effect the reduction simply by zinc and hydrochloric acid.

The regenerated electrode which has been purified from foreign substances and thoroughly rinsed, again and again serves as anode in the electrolytic removal of foreign ions and so on.

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ALIEN PROPERTY CUSTODIAN

POLARISING FILTER AND METHOD OF MAKING THE SAME

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No Drawing. Application filed June 27, 1940

The invention relates to polarising filters and particularly is directed to a novel method of making the same.

It is known to make polarising filters from dichroitic monochrystal layers and protect the same against exterior influences by cementing the same between two glass plates. According to another method minute dichroitic crystals are embedded or produced within an isotropic carrier medium which preferably is initially in a semifluid condition permitting the produced mixture to be poured out in the form of a layer. At the same time the dichroitic particles are uniformly positioned to orient themselves in the same general direction by subjecting them to mechanical, electrical or magnetical forces. Such polarising filters may be made of various known dichroitic crystals, for instance the iodine addition products of quininesulphate (herapathite), the iodine addition compounds on other heterocyclic bases, as for instance toluidine, cinchonine, picoline, quinoline, quina-aldine etc. In place of iodine it is also possible to employ bromine or metallic salts with heterocyclic bases. As carrier substance of initially fluid consistency for these small crystals preferably cellulose or derivatives of cellulose, gelatine, artificial resins etc. are used.

Another known method for making dichroitic polarising filters consists in suitably dyeing optically anisotropic bodies, preferably anisotropic layers. It is, for instance, possible to treat a cellulose fibre of a thickness of not more than 1μ with chloride of zinc iodine and thereby impart to the fibre such pronounced dichroism that the fibre in polarised light when positioned lengthwise parallel to the plane of polarization appears to be entirely colorless, but that it appears black when the fibre is positioned to traverse the plane of polarization. There exist a multiplicity of possibilities in the selection of anisotropic bodies of relatively great areal extent which are adapted when dyed to form polarising filters and there is also a great number of dyes available for this purpose. Particularly adapted for this purpose are foils made from cellulose or cellulose derivatives which are obtainable at the present time on the market under different trade names, as Cellophane, Transparit, Cuprophane, Ultraphane, Pliaphane etc. Artificial resins, gelatine and other substances likewise may be used. The number of dyes which will produce the desired results is quite large. Among others a great number of idiochromatic or allochromatic substances may be used, as methylene blue, Congo red etc. and all elements as copper, silver, gold, mercury, arsenic, antimony, bismuth, selenium, tellurium, bromine, iodine and others, as well as compounds of the same. It is also well known that it is feasible to start with ordinary isotropic bodies and render the same anisotropic by suitable treatments, for instance by stretching or thinning. When foils are employed which possess inherently anisotropic properties, it is in many cases of value to increase the anisotropic condition by stretching or thinning the foils. In certain cases, however, such special treatment can be entirely dispensed with.

A very suitable dye for treating foils of cellulose or of cellulose derivatives to render the same dichroitic is iodine. The iodine preferably is introduced into the foil indirectly from the chloride of zinc iodine, or by displacing it from potassium iodine by gaseous chlorine, or it may be introduced in the form of other well known organic or inorganic iodine compounds.

Polarising foils produced in the above described manner have a very limited durability only, since the dye disappears relatively fast from the carrier by itself and particularly by sublimation.

It is an object of the present invention to increase the durability of polarizing filters made by dyeing an optically anisotropic carrier layer.

Another object of the invention is to increase or improve the polarizing property of the above named polarizing filters.

In accordance with the present invention the optic anisotropic carrier layer is first thoroughly dyed throughout the whole body so that the dye penetrates the entire layer, and then the dye content of the layer is reduced again to the desired density or transparency. This reduction of the dye may, for instance, be obtained by washing a portion of the dye out of the layer. In this manner a polarising layer is obtained in which the dye is seated principally in the intermediate part, the innermost portion of the layer. A polarising filter produced in this manner has greater durability than the polarising filters as heretofore produced, and in addition, it also has increased polarising power.

The excess dye may also be eliminated from the foil by the action of heat or by the action of chemical substances. Apparently these steps are effective in positioning the dye principally within the innermost stratum of the foil, while the outer strata of the foil are substantially cleared of dye.

After the foil has been thoroughly dyed and

then has been washed to remove the excess dye, the foil may be further improved by suitably stretching the same while still wet so as to increase its anisotropic qualities. Preferably, the foil remains stretched i. e. under tension until it is completely dried. Owing to the drying step the tension in the foil is still more increased. Therefore, the stretching of the wet foil is preferably determined so that the final tension set up in the foil during the drying period will stay just below the limit of the tensile strength of the material.

The method of making polarising filters according to the present invention may also be practiced in such a manner, that the various steps as dyeing, washing and stretching are repeated in any desired sequence, for instance the carrier layer may be stretched to a certain degree before the dyeing takes place, and then the layer may be stretched again, even repeatedly, after it has been dyed. Likewise the dyeing may be repeated after each stretching operation. The polarising filters produced in this manner are extremely effective and durable. The method of the invention is not limited to the use of iodine as dye, since other dye stuffs also may be employed with good result.

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ALIEN PROPERTY CUSTODIAN

PROCESS OF PREPARING ACETOACETIC ESTERS

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No Drawing. Application filed June 15, 1940

The present invention relates to a process of preparing acetoacetic esters.

Various processes are already known for causing aliphatic and cyclic compounds containing hydroxyl groups to react with diketene so as to obtain acetoacetic esters by using as an esterification catalyst for instance hydrogen chloride, sulfuric acid or sodium bisulfate or metallic sodium. The reaction of organic compounds containing sulphur, such as mercaptans or thiophenols, with diketene so as to obtain thio-acetoacetic esters has, however, not yet been described.

Now we have found that, in general, organic compounds with groups capable of being esterified, for instance alcohols, phenols, mercaptans or thiophenols, may be added on diketene so that acetoacetic esters or thioacetoacetic esters are formed by performing the reaction in the presence of organic bases with tertiary nitrogen atom or of salts having an alkaline reaction in aqueous solution. The compounds named are capable of activating the diketene in such a manner that it polymerises in case no other reactive compounds are present, but that in the presence of compounds capable of being esterified it is added on said compuonds with formation of acetoacetic esters.

There may be used for instance trimethylamine, triethyl-amine, tripropyl-amine, tributylamine, dimethyl-ethyl-amine, triethanol-amine, piperidine, picoline ethanol-piperidine, potassium-, lithium- and sodium-acetate, secondary and tertiary potassium- and sodium-phosphate, potassium- and sodium-silicate, potassium- and sodium-sulfite, borax, potassium- and sodium-stearate or the like. All these catalysts may be used in a proportion of about 0.01 per cent up to about 1 per cent calculated upon the diketene. A larger quantity has no detrimental action but in general it is useless.

It may be advisable to add, besides the substances named, also a small quantity, for instance one-tenth to one-half of the catalyst, of organic acids, particularly aliphatic carboxylic acids, such as acetic acid, propionic acid, butyric acid, or the like, for preventing the formation of by-products by the polymerization of the diketene. In the reactions described these acids, if applied alone, are entirely ineffective as a catalyst. The most favorable ratio between catalyst and acid may empirically be found out in an easy way and lies for instance in the case of sodium acetate and acetic acid at about 1:7 and in the case of borax and propionic acid at about 1:3.

Diketene and the compound capable of being esterified are in general applied in about equimolecular proportions. The reaction is strongly exothermic. By suitably cooling it is possible to keep the temperature setting in so low that the addition product is not injured. The reaction may be performed without any difficulty in a continuous manner.

As starting materials there may, for instance, be used methyl-alcohol, ethyl-alcohol, propyl-alcohol or isopropyl alcohol, the isomeric butyl- and amyl-alcohols, oleyl-alcohol, glycols, such as 1.3-butylene-glycol, phenol, the cresols and xylenoles, thiophenol, the thiocresols and methyl-, ethyl-, propyl- and butyl-mercaptane.

In comparison with the known processes likewise operating with application of diketene, the process herein described has the advantage that it is not necessary to eliminate the basic compound acting as a catalyst from the mixture after the reaction has taken place, whereas the hitherto used catalysts had always carefully to be removed in order to avoid during a further treatment by distillation a saponification or decomposition of the acetoacetic ester formed. Moreover, strong discolorations readily occur in the known processes; owing to said discolorations it is hardly possible, particularly if sensitive and not distillable acetoacetic esters are concerned, to use them for industrial purposes. The esters obtained according to the present invention may, however, be used for most of the industrial purposes, since the reaction may be carried through already at so low a temperature that careful reaction conditions are given. Finally very good yields are obtained according to the present process; they exceed the hitherto known yields and it is not necessary to apply a hitherto usual excess of for instance alcohol.

The following examples serve to illustrate the invention, but they are not intended to limit it thereto, the parts being by weight:

1. Into a solution preheated to 60° C. of 0.6 part of triethyl-amine in 160 parts of methyl alcohol there are introduced, drop by drop, while stirring, 420 parts of diketene with such a speed that the temperature during the reaction may be kept by an occasional cooling at 60° C.–70° C. After the entire quantity of diketene has been introduced stirring of the mixture is continued until the reaction is complete and the mixture is then subjected to a fractional distillation under a reduced pressure of 20 mm. The acetoacetic acid methyl ester distilling at 70° C.–73° C. under a pressure

of 19–21 mm is obtained in a yield of about 95 per cent of the theoretical yield.

2. From 828 parts of absolute ethyl alcohol and 1512 parts of diketene there are obtained, in the presence of 1.2 parts of triethyl-amine, in operating in a manner analogous to that of Example 1, 95 per cent of the theoretical yield of acetoacetic acid ethyl ester.

3. 230 parts of absolute ethyl alcohol are caused to react, as described in Example 1, with 420 parts of diketene in the presence of 1.3 parts of dehydrated sodium acetate so as to obtain acetoacetic acid ethyl ester. The yield amounts to about 85 per cent of the theoretical yield.

If the reaction is performed in the presence of 9.1 parts of glacial acetic acid or propionic acid, the yield increases to 90 per cent of the theoretical yield.

4. 500 parts of crude-diketene, containing 428 parts of pure diketene, 43.5 parts of acetic anhydride and 28.5 parts of higher ketene polymers, are mixed with 1.3 parts of dehydrated sodium acetate and the mixture is caused to react, as described in Example 1, with 254 parts of absolute ethyl alcohol (calculated upon the pure diketene + acetic anhydride). An addition of acetic acid is not necessary since acetic acid is inevitably produced by the reaction of the anhydride with the alcohol. About 90–95 per cent of acetoacetic ester calculated upon the pure diketene are obtained.

5. 240 parts of ordinary ethyl alcohol containing about 4 per cent of water, 420 parts of diketene, 1.3 parts of sodium acetate and 9.1 parts of glacial acetic acid are caused to react in a manner analogous to that of Example 1. The yield of acetoacetic ester amounts to about 85 per cent of the theoretical yield.

6. 46 parts of absolute alcohol are condensed as described in the preceding examples with 84 parts of diketene in the presence of 0.25 part of secondary sodium phosphate, while adding 1.25 parts of acetic acid. Instead of secondary sodium phosphate there may be used, as a catalyst, borax or another salt named in the specification. The yields of acetoacetic ester are between 80 and 90 per cent of the theoretical yield.

7. 84 parts of diketene are dissolved in 74 parts of n-butylalcohol and there are added to the solution at room temperature, while stirring, first 1.5 parts of glacial acetic acid and then 0.3 part of pyridine. The reaction sets in at once with a strong evolution of heat and is terminated after a few minutes. The temperature may rise up to the boiling point of the ester formed. By a distillation of the mixture under reduced pressure there are obtained 85 per cent of the theoretical yield of acetoacetic acid-butyl ester boiling at 79°–C.–80° C. under a pressure of 10 mm.

8. 74 parts of anhydrous, tertiary butyl alcohol are condensed, as described in Example 7, with 84 parts of diketene in the presence of 0.3 part of triethyl-amine so as to obtain acetoacetic acid ester of the tertiary butyl alcohol. The ester boils at 55° C.–57° C. under a pressure of 3.5 mm and is obtained in a yield of 85 to 90 per cent of the theoretical yield.

9. 137 parts of commercial oleyl alcohol (6.2 per cent of OH) are caused to react, in a manner analogous to that described in Example 1, at 100° C. with 42 parts of diketene in the presence of 0.2 part of triethyl-amine. The ester formed is distilled under a reduced pressure of 4 mm. The ester boils at 185° C.–220° C. with a slight decomposition. The yield amounts to about 85 per cent of the theoretical yield.

10. 45 parts of 1.3-butyleneglycol are condensed, as it is described in Example 1, with 84 parts of diketene under the action of 0.26 part of sodium acetate, while adding 1.82 parts of glacial acetic acid. During the condensation both OH-groups are esterified. The feebly yellow mixture is washed with water and then dried under reduced pressure. The ester is not distillable; the yield of crude ester amounts to 80–85 per cent of the theoretical yield.

11. 47 parts of phenol, 42 parts of diketene and 0.1 part of sodium acetate are caused to react at 75° C–80° C, as it is described in the preceding examples. The acetoacetic acid phenyl ester is obtained in a good yield and boils at 130° C–142° C under a pressure of 7 mm.

12. 43 parts of thiophenol are condensed, as it is described in Example 1, at about 55° C with 33 parts of diketene in the presence of 0.08 part of triethylamine so as to obtain the acetoacetic acid ester of thiophenol. The crude ester of a feebly yellow coloration is not distillable and for eliminating the triethyl-amine, the ester is heated for a short time under a reduced pressure of 3 mm to 50° C–60° C. There are obtained 74.8 parts of crude ester which is nearly pure as has been ascertained by analysis.

13. 65.5 parts of ethyl-mercaptan, 88 parts of diketene and 0.3 part of triethyl-amine are caused to react in a manner analogous to that described in Example 12. At the beginning of the operation the temperature is kept, by cooling, at about 30° C; pari passu with the progressing reaction it is, however, gradually raised to about 60° C. Contrary to the acetoacetic acid ester of thiophenol, the acetoacetic acid ester of ethyl-mercaptan obtained in a good yield is distillable, though with a slight decomposition; it boils at 66° C–73° C under a pressure of 2–3 mm.

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ALIEN PROPERTY CUSTODIAN

CASES FOR SOUND FILMS

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Application filed June 29, 1940

In case of sound films it is not possible to bring the title of the composition on the sound holder itself as it can be done with records. For this reason the case containing the sound film is usually to be provided with the corresponding inscription.

The present invention is to solve the problem to give the sound film case such a form as is necessary for easily and clearly arranging it in connection with other sound film cases and which, therefore, will better serve the purpose intended.

The invention is based on a sound film case having rectangular bottom and lateral walls. Such flat cases are usually piled one upon another. As the sound film cases, when being used, are pulled out of the pile, it is very difficult to keep them in good order as long as they are disposed in the manner just described, the more so as the upper part of the pile will slide downwards and get disordered, when a sound film case is pulled out from the lower part of the pile. Rearranging a sound film case in the pile, in which the films are disposed e. g. according to composers, kinds of music or the like, is still more difficult than taking it out from the lower part of a larger pile.

Object of the present invention is to avoid these and further disadvantages of the known types of cases for protecting sound films and to provide a film case which can be easily and clearly arranged in connection with other works of literature and musical art. According to the invention this is obtained by the fact that one narrow face is formed like a back of a book and bears designations concerning the contents of the sound film case and the sound film. So the possessor of sound film cases will necessarily place the same side by side, using the lower lateral faces as a base. Hereby a very clear arrangement of the cases is possible, which arrangement can always be observed as, when taking out of the whole a certain sound film case, the position of the others is not affected, a free space remaining which designates the site of the removed case.

At the same time such a form of the sound film case is adapted in a very good manner to the character of the sound film as a work of literature and musical art. In this way it is also possible to range the sound film cases decently in a library together with other regular books. In this connection, of course, it is necessary to overcome the prejudice that a film coil maintains its shape in lying condition only. In fact, experience has shown that a film coil is not affected by placing it vertically, so that the slight change of form which the coil is subject to by the said manner of placing it, is adjusted already after a few turns on the film table of the musical apparatus.

It is advantageous to form from one bottom wall and the four lateral walls an open film case for the sound film, which case is covered by the other bottom plate being constructed in such a way that it can be unfolded. It is recommendable not to bring the designations directly on one lateral wall of the case but to bring them on a wall covering the said lateral wall and which can be unfolded together with the corresponding bottom wall when opening the case. It is also advantageous to provide the bottom wall to be unfolded with vertical lateral walls which are to cover the lateral walls being arranged on the other bottom wall and, therefore, ensure tighter closing. In order to obtain still a better result, an intermediate cover covering the top of the case may be provided, which may bear at the same time indications concerning the contents of the sound notes made on the sound film.

The invention is illustrated in Figures 1 and 2 of the drawing.

Figure 1 shows the sound film case in closed and Figure 2 shows it in open condition, in a diagrammatical view.

The case is substantially formed by the rectangular bottom walls *a* and *b* and the four rectangular lateral walls b_1, b_2, b_3, b_4, which are firmly connected to the bottom wall thus forming together with it an open box, which is to preserve the endless sound film. This film is directly covered by an intermediate cover *e* which can be unfolded. The bottom wall *b* which can likewise be unfolded, is connected to the unfoldable lateral wall *d* covering the lateral wall b_4. It is provided on three sides with rectangular lateral walls f_1, f_2, f_3, which cover the lateral walls b_1, b_2, b_3, if the case is closed.

The unfoldable wall *d* connecting the bottom walls *a* and *b* to each other is formed like the back of a book and bears inscriptions and other marks which refer to the contents of the sound film case and eventually of the sound film. Owing to such a form of the lateral wall *d* the possessor of the sound film box will necessarily use the lateral wall b_1 as a base when ranging several cases side by side.

KARL DANIEL.

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JUNE 1, 1943.

BY A. P. C.

K. DANIEL

CASES FOR SOUND FILMS

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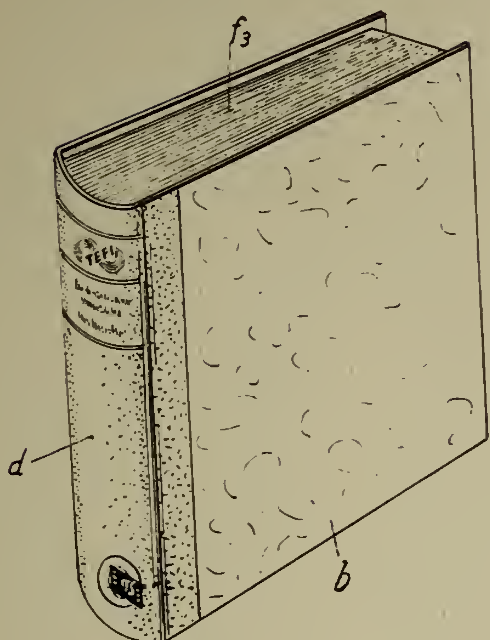

Fig. 1.

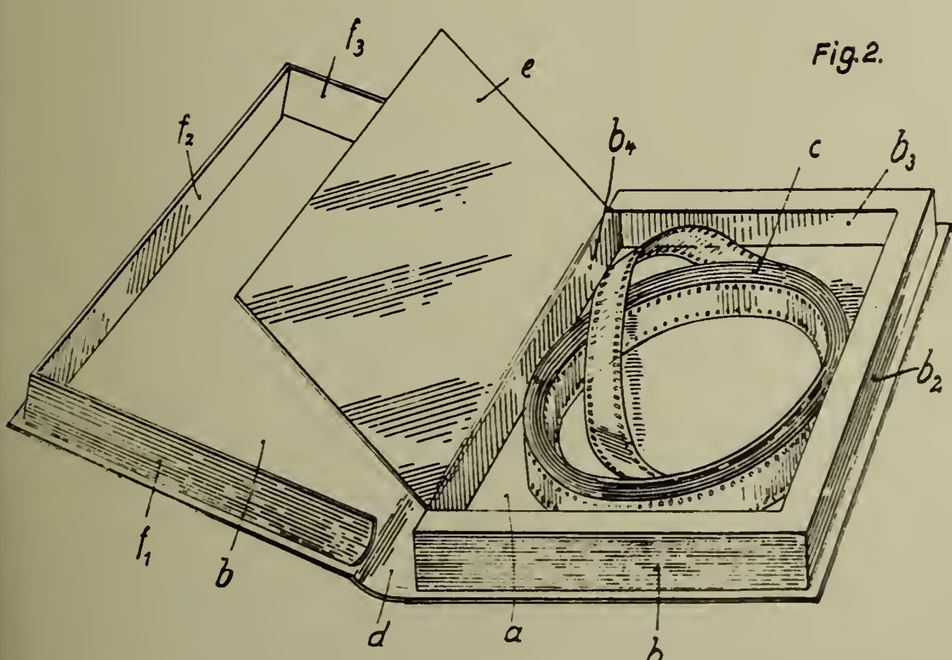

Fig. 2.

Inventor:
KARL DANIEL

By: Richards & Geier
Attorneys:

Published June 1, 1943

Serial No. 344,220

ALIEN PROPERTY CUSTODIAN

METHOD AND APPARATUS FOR ELECTRIC RESISTANCE WELDING OF TUBES

David Sciaky, Paris, France; vested in the Alien Property Custodian

Application filed July 6, 1940

In the electric welding of tubes by overlapping of the margins of the tube, the work may be formed under its final shape prior to bring the same to the welding machine and, in such a case, the edges of the work are not to be brought together prior to welding the same.

However the known methods of electrical welding by overlapping of the margins of the work have the drawback to unduly overheat the work piece in the part which is adjacent to the weld. Therefore, the tube is out of shape when it is delivered from the machine and it is often necessary to subject the same to a heat treatment, follower by a reforming operation.

When using tubes of stainless austenitic steel with 18% of chrome and 8% of nickel, the heat treatment is needful and must be followed by a cold drawing operation, in view to give back to the metal the cold-hammering grade lost during the heat treatment.

This invention has for its object to avoid this drawback and to perform the electric welding of tubes by overlapping of their margins without material heating of the work and mainly of the parts of the same which are adjacent to the weld. Furthermore, the invention aims to eliminate the deformation of the tubes during the welding.

The invention relates to a method for electric welding of tubes by overlapping of the margins, characterised by the feature that the work is brought on a conducting mandrel, said work is held along two of its generative lines, the overlapped margins of the tube are longitudinally tensioned, a welding current is caused to pass between the generatrix along which the work is maintained and said overlapped margins of the tube, which enables to decrease the needless heating of the work and to cause a material part of the heat generated during the welding to escape through the way of the mandrel.

The invention relates also to an apparatus to carry out the above described method, characterised by a guiding support, which serves also as electrode, which is tangent to the work along two generatrix, and an upper welding electrode bearing on the overlapped margins of the work, which arrangement enables to guide this work along a substantial length under the welding electrode and reduces to the minimum the cross area of the flow which passes from the guiding support serving as electrode to the upper welding electrode.

According to an embodiment of the invention, the support serving as guiding electrode is V-shaped in cross section, which enables to use this support for the welding of tubes of different diameters.

Other features of the invention will appear in the following specification.

A welding apparatus according to the invention is shown by way of example in the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of this apparatus.

Fig. 2 is a cross sectional view of said apparatus, along the line 2—2 of Fig. 1.

Fig. 3 is a diagrammatic view illustrating the flow of welding current.

Fig. 4 is a diagrammatic view illustrating the manufacture of tubes having different diameters in the same apparatus.

Fig. 5 is a cross-sectional view illustrating another embodiment.

The apparatus shown in Figs. 1 and 2 is provided with a horizontal support **1**, on which the tube is supported and which serves also as electrode. This tube support may slide longitudinally. It is provided with a V-shaped cavity in its upper part along a length which is substantially equal to that of the work to be welded and, in its under part, it is provided with a groove **3** extending along its full length to serve as a track for a roller acting as electrode.

The work **4**, whose margins are overlapped, is placed on a mandrel **5** and the whole is laid down in the cavity **2**, so as to have the overlapped margins of the work on the upper part of the mandrel **5**. The left part of the work and also of the mandrel is clasped in the pinching device **6** provided with flexible arms **6**, the screw **7** serving to this purpose. This pinching device is extended rearwards to a squared rod **8**, which slides longitudinally in the part **9** integral with the support **1**. The squared part **8** is extended by a screw-threaded rod **10** upon which is screwed a nut **11** which rests on the support **1**. By screwing the nut **11**, the pinching device **6** is caused to draw the work **4** in the longitudinal direction, together with the mandrel **5**.

The right end of the work has its overlapped part clasped by the pinching device **12** provided with flexible arms by means of the screw **13**. This pinching device is also secured to the support **1**.

The whole of the work and of the mandrel is also secured crosswise by any suitable means, such as spring-pressed bolts **14**[1], **14**[2]. These bolts are pressed by springs **15**[1], **15**[2], which slide in the support **1** and push the work on the mandrel, whilst a free movement is permitted to the upper roller **16**.

A stationary roller **17** serving as electrode constitutes a pole of the source of current; this roller is placed under the support **1** and bears against the latter in depth part of the under groove **3**. A roller **16** serving as electrode constitutes the other pole of the source of current and is vertically movable by any suitable means; this roller bears on the overlapped margins of the work **4**

and is arranged in the same vertical plane as the under roller 17.

The source of current is generally constituted by a static transformer, whose primary winding is connected to the supply main and whose secondary winding, connected at its ends to the rollers 16 and 17, delivers a current of low voltage and of very high amperage.

The support 1, the mandrel 5 and the rollers 6 and 7 serving as electrodes are of a metal which is a good conductor, e. g. of red copper.

The operation of the welding apparatus is as follows:

The work 4, provided with its mandrel, is placed in the cavity 2 of the support, with the part to be welded turned upwards; the two overlapped margins of one end are clasped in the gripping device 12 by tightening the screw 13. The pinching device 6 is then slidably moved towards the other end of the work; this end is clasped together with the mandrel through the screw 7. When the nut 11 is rotated, the pinching device is drawn, so as to tension the work in the longitudinal direction, particularly the upper part of the same.

The upper roller 7 is pressed on the overlapped margins of the work and the whole of the support 1, the work 4 and the mandrel 5 are moved longitudinally between the stationary rollers 16 and 17 serving as electrodes.

The electric flow follows the track shown in Fig. 3. It comes to the upper roller 16, concentrating itself in the overlapped margins of the work 4, whence it divides itself into two symmetrical derivations, each passing through the lateral line of contact of the work 4 with the support 1. This line passes substantially at the points 18^1 and 18^2 shown in the cross-sectional view of Fig. 3. Both derivations of the flow are united together at the line of contact of the lower roller 17 with the support 1. The longitudinal displacement of the whole of the support 1 may be performed by any known mechanical or electrical means. In the embodiment shown by way of example in the drawings, both rollers 16 and 17 serving as electrodes may be driving rollers; however it is easy to imagine that both rollers will be loose on their respective shafts and that the whole of the support 1 shall be displaced by a toothed rod or any other suitable means.

By way of example, the speed of displacement of the support may be of the order of 7 to 70 feet per minute. The gripping pressure of the electrodes may be of the order of 300 to 1500 pounds per square inch according to the diameter of the work, the sort of the metal and its thickness. The electric current may be passed step by step between the rollers 6 and 7 so as to make very close welding points; by way of example, with a current of 50 cycles per second, it is possible to cause this current to pass during two cycles in each series of eight.

The above described device has the following advantages:

1. The work is tensioned in the longitudinal direction so as to prevent its deformation under the welding heat. It is to be observed from the Fig. 1 that at one end, the work and the mandrel are held together by the pinching device 6, whilst at the other end only the upper end of the work is clasped by the pinching device 12. This enables to tension easily the work at its upper part without this tension may be counteracted by the mandrel 5.

2. The guiding support 1, which is tangent to the work along its generatrix 18^1 and 18^2, secures the contact and the guidance of this work along a considerable length under the welding roller.

3. The electrical flow pass through the work 4 at the point of contact of the roller 16 with the overlapped margins of this work on the one hand and at the lateral points of rest 18^1 and 18^2 of the work on the V-shaped support 1 on the other hand. This arrangement eliminates the undue heating of the cross area of the work between the two lateral points of rest 18^1 and 18^2 and the weld. The power amount which is necessary for the welding operation is thus reduced to the minimum.

4. The mandrel 5, inserted in the work and extending in the whole length thereof, performs all operations comprising the transmission of the pressure power on the weld, the conduction of the welding current and the evacuation of a considerable part of the heat evolved by the welding operation. It is thus possible to weld tubes having very small diameters, because no access is necessary in the interior of the work in view to perform any mechanical or electrical operation.

5. The tube of austenitic steel (e. g. of stainless steel having 18% of chrome and 8% of nickel) are subject to lose their corrosion resisting properties under an undue heating. When the method according to this invention is used for such tubes, an injury of the metal is avoided by the suppression of the heating of the tube in the cross area of the tube between the lateral points of rest 18^1 and 18^2 and the weld, and also by the quick evacuation of the heat in the mandrel 5, which is a good conductor.

It is also possible to use for the production of the work a band of metal which is hard-hammered by cold rolling without the risk to lose the high mechanical strength of the metal.

With the above-described method, it is now possible to weld in securing a very accurate diameter and the above-mentioned advantages very thin tubes, e. g. of steel alloys, special chrome-nickel steel, light alloys, etc.

This method enables also to obtain a very quick manufacture, because the suppression of the prejudicial heating make possible the use of welding currents having a considerable amperage.

The shape of the support 1 was shown only by way of example.

In fact, other shapes are possible for this support. Particularly, instead to have a V-shaped support, it is possible to use a half-circular support (Fig. 5), the work being also in contact with said support by two generatrix.

In addition to the above-mentioned advantages, the V-shape enables to weld, on a single support, works having different diameters. These works may also have an oval, rectangular or other suitable cross-sectional shape, the shape of the support being always such as to ensure the contact with the work along two opposite generatrix of the latter.

The mandrel 5 may be provided with a longitudinal bore to enable an intense cooling by a current of water or other suitable fluid.

DAVID SCIAKY.

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BY A. P. C.

D. SCIAKY
METHOD AND APPARATUS FOR ELECTRIC
RESISTANCE WELDING OF TUBES
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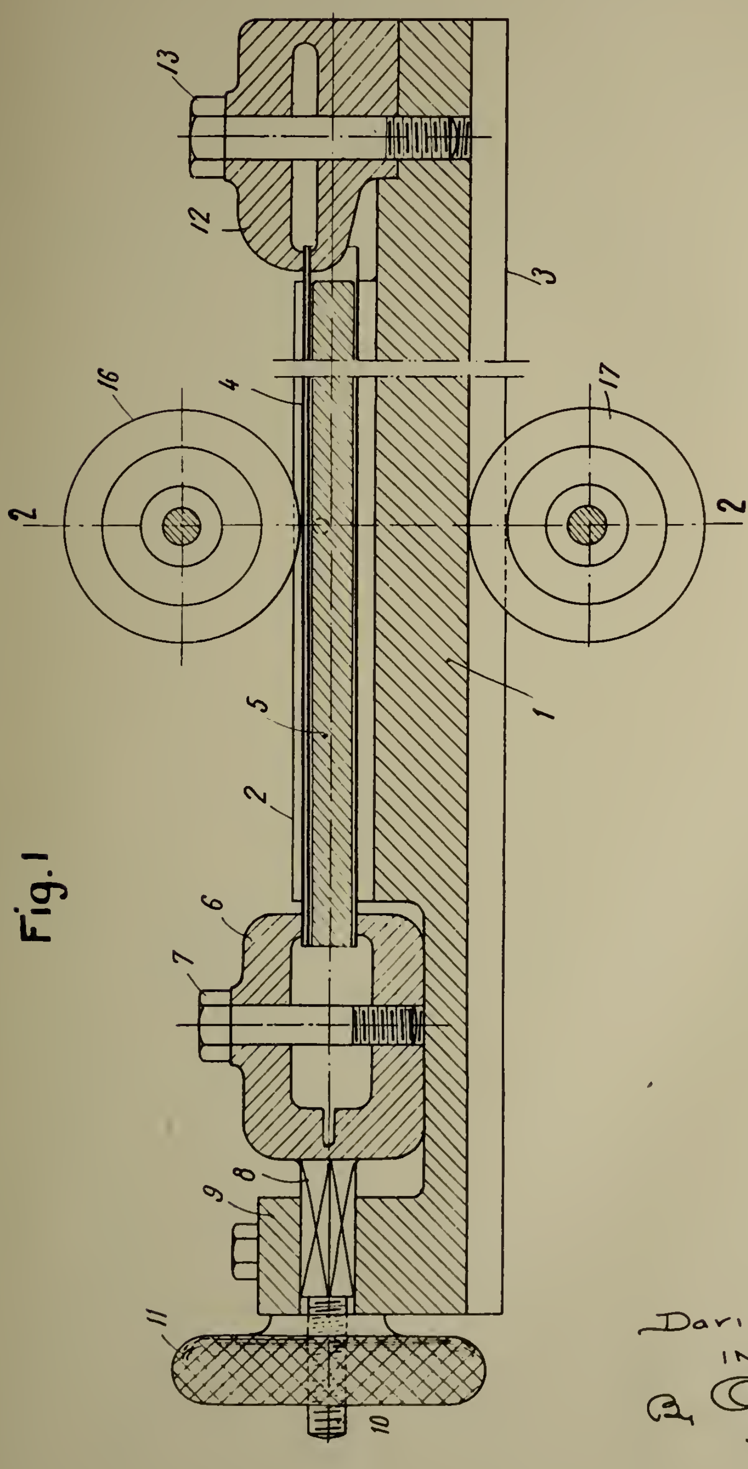
Serial No.
344,220
2 Sheets-Sheet 1

Fig. 1



David Sciaky
INVENTOR
By Otto Munk
his ATT'Y

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2 Sheets-Sheet 2

Fig.3

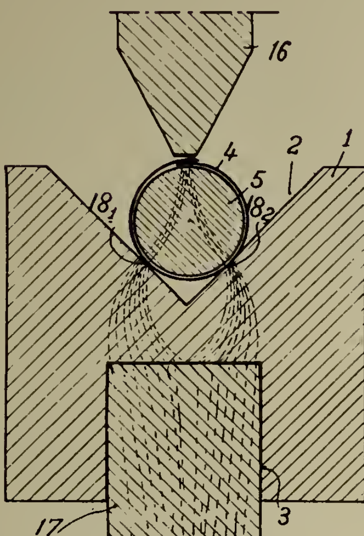


Fig.4

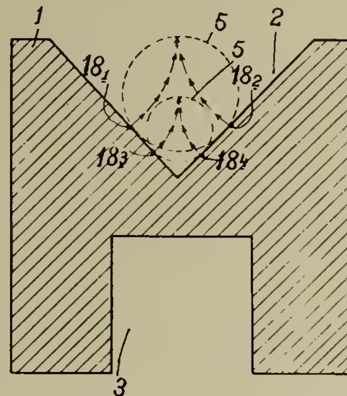


Fig.2

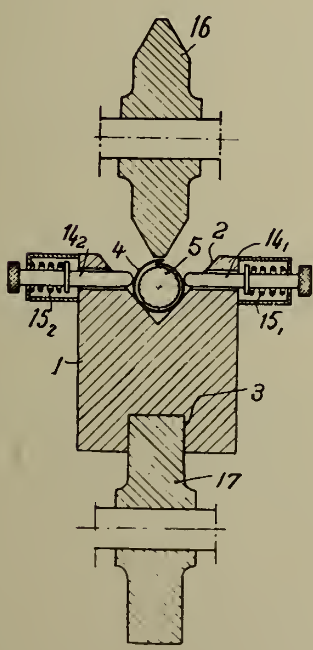
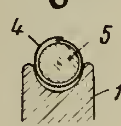


Fig.5



David Sciaky
INVENTOR
By [signature]
his ATT'Y.

Published June 1, 1943

Serial No. 346,638

ALIEN PROPERTY CUSTODIAN

PERCUSSION CAP SAFETY DEVICE FOR PERCUSSION FUSES

Cesare Del Prato, Naples, Italy; vested in the Alien Property Custodian

Application filed July 20, 1940

The present invention relates to a percussion cap safety device for percussion fuses.

According to the invention the safety device suggested is such that a section of the fire conduit is constituted by elements of which one is fixed, and the other mobile. Between these elements there is inserted a grain having such an outside shape that it may act as a valve, and being provided on one side with a blind cavity. In position of rest the outside part of the grain lies against the edge of the fixed part of the fire conduit and closes the same; the internal blind cavity, equally in position of rest embraces the end of the mobile conduit.

The device according to the invention is furthermore characterised by a free internal cavity having such form and dimensions as to permit the accommodation of the valve-shaped grain in a free position outside the fire conduit.

The device is schematically illustrated in the accompanying Fig. 1 showing a partial section of a fuse to which the same device has been applied.

As shown in said figure a part of the fuse body in whose cylindrical, axial cavity there is lodged a mobile element of the fire conduit **2**, kept on the spot in resting position, by means of any system whatever for making the fuse "live" not shown in the drawing.

Within the fuse body there is inserted another fixed element of the fire conduit **3** acting as valve seat. Between these elements there is interposed, in correspondence with a free chamber **4** a grain **5** whose outside shape is capable of acting as a valve, comprising inside, a blind cavity. The outside part of said grain lies, in resting position, on the edge of the fire conduit **3** and blocks the same while the internal blind cavity encloses the lower end of the mobile element **2** of the fire passage.

Said chamber **4** has such convenient form and dimensions as to permit the accommodation in a not obligatory position of the valve shaped grain, when this grain is disengaged from the fire conduit.

The device functions as follows:—

When the shot is fired (see Fig. 2) the mobile section of the fire conduit is disengaged from the safety system and successively, the action of the gases of the direct fire charge having ceased, the conduit remains free, owing to retardation or another force, to advance, allowing in its turn the valve shaped grain **5** to be displaced, which owing to gravity or another force is lodged in the chamber **4** already mentioned, disengaging itself from the fire conduit.

In the case of an unlooked for, spontaneous deflagration of the cap, the action of the same cap is developed on the valve shaped grain, obliging the same to strongly adhere against the respective seat, thus improving the closure of the fire conduit. In this manner the propagation of the priming of the cap is avoided.

The present invention has been illustrated and described in a preferred form of realisation but it is understood that constructive changes may be practically introduced without surpassing the limits of protection of the present industrial patent.

CESARE DEL PRATO.

PUBLISHED

JUNE 1, 1943.

BY A. P. C.

C. DEL PRATO

PERCUSSION CAP SAFETY DEVICE FOR PERCUSSION FUSES

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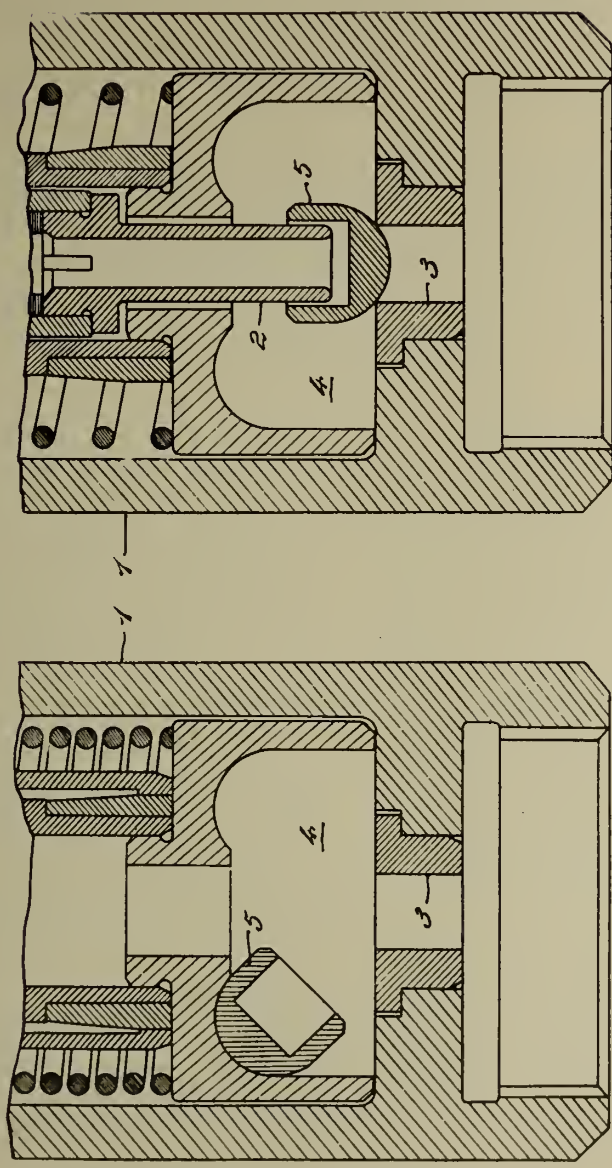
Fig. 2

Fig. 1



Inventor,
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By: Glascock Downing & Seebold
Attys.

Published June 1, 1943

Serial No. 346,649

ALIEN PROPERTY CUSTODIAN

NAUTICAL DEVICE WITH CIRCULAR FLOATS ROTATING AND RUNNING UPON THE SURFACE OF THE WATER

Aldo Croff, Milan, Italy; vested in the Alien Property Custodian

Application filed July 20, 1940

The object of the present invention is a nautical device formed by one, two or more circular floats adapted to be rotated and runned upon the water's surface by any motor means.

In the case of a device comprising a single float device, on the inside periphery of the latter are arranged one or two circular guiding rails on which can run a motor-vehicle or truck, which, in its motion, causes said guides to revolve carrying around the float in their revolution.

In this case, in order to maintain the equilibrium of the device, from the motor-vehicle or truck extend two arms sideways carrying at their end a small float bearing on the water's surface.

In the case of a device with two or more floats, these are coaxial, parallel arranged, suitably spaced and connected by a frame or cage wherein are fixed one or two circular guiding rails on which runs the said motor-vehicle or truck.

In both cases said motor-vehicle or truck moves on said guides, and due to its weight causes the rolling of the floats, remaining itself essentially horizontal.

The rolling floats may be provided with paddles or other means to secure a certain grip into the water.

The attached drawing shows diagrammatically, by way of example, only an embodiment of the invention as applied to a device with two floats.

No. **1** indicates the two floats, which can be made of any convenient material (wood, light metal or alloys, rubber etc.); **2** are cross-bars of any convenient material, rigidly connecting floats **1** one to another so as to form a cage in form of a spool. **3** are two guides or circular-rails fixed in the inside on cross-bars **2**. On said rails runs a motor-vehicle or truck (not shown). The sections of said rails will be suited to the kind of vehicle used.

The device according to the present invention has the object of eliminating most of the resistance opposing the motion on the water of said apparatus, by converting, in the way specified, the sliding friction into rolling friction. In fact the device, instead of gliding, rolls upon the surface of the water.

Besides, due to the speed, this device has a definite tendency to lift, thus reducing to the strictest indispensable minimum its contact with the water.

It should be understood, of course, that the cross-section of the floats may vary from the square section shown in the drawing and that the construction and form may also vary in practice from those specified and illustrated, without changing anything in the principle of the present invention.

A. CROFF.

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A. CROFF
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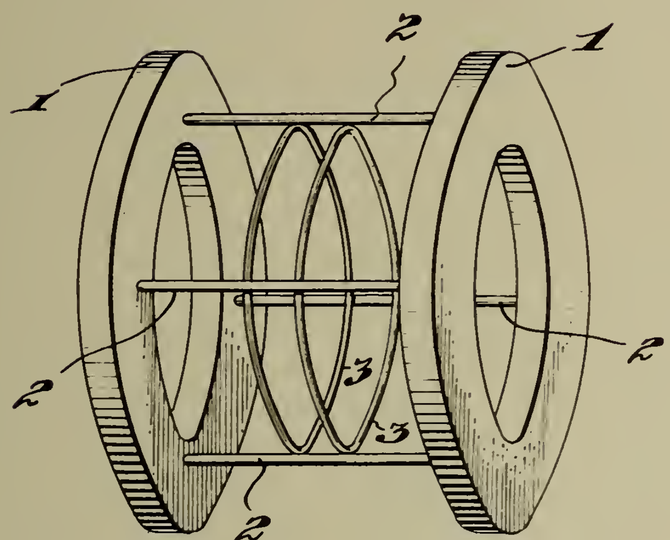

Inventor;
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By: Attorneys.

Published June 1, 1943

Serial No. 347,464

ALIEN PROPERTY CUSTODIAN

BOOKKEEPING MACHINES OR THE LIKE

Hans Möller, Johannes Sobisch and Felix Loebe, Bielefeld, Germany; vested in the Alien Property Custodian

Application filed July 25, 1940

The invention relates to a bookkeeping machine, or the like, utilizing record sheets with sensible indicia, and particularly one having a comparing device. In such machines it is already known to carry out tabulating operations in dependence upon group-identifying marks and upon disagreement between the punched group-identifying marks with the setting of the machine, to stop the same, or to cause it to carry out in a certain way special machine operations.

Furthermore, it is customary to arrange for an account card inserted into the machine to have its last printed line fed into the sensing position simultaneously with the setting of the line to receive a new record at the recording position, whereby the sensing and recording operations are made to take place in the same position of the card. These machines, however, have no comparing means for testing the correctness of the card inserted.

Other tabulating machines are provided with a punched band, which is periodically divided into successive fields. In each field there is a special punching representing an identifying number. The fields are thus able to take up punched entries from punched cards of the same identifying sign, the correct section of the band for the entries being first selected by a comparing process, and then the line of the selected section which is to receive the record being moved to position. Then follows a transfer of the punched value from the punched card to the new line of the selected section.

Such a method of operation may be of advantage in cases where unsorted cards are fed to the machine, or a punched band with successive sections having a different sign is used. However, it is unsatisfactory if there are fed into the machine cards, or the like, already sorted, which serve both as the means from which the bookkeeping values are to be taken and upon which they are to be recorded.

In such cases the best system will be one using record bearing cards, or the like, which can be sensed in any suitable manner. In most kinds of bookkeeping operations there would therefore be a time-consuming interruption of the natural course of the bookkeeping operation, caused by the comparing procedure which must precede the sensing of the card.

These disadvantages are removed by the invention, in accordance with which the sensing of the identifying and accounting indicia of the cards, or the like, as well as the selective positioning of the parts of the card to be sensed and to receive impressions, takes place collaterally with the comparison of the identifying indicia of the card with the setting of the machine, but before the result of the comparing process has been worked out. In dependence upon the result of the comparing process the sensed values are then recorded in known manner, as well as automatically entered in a balance mechanism, and the new balance, or the like, formed by the entry of a value changing the old balance, is recorded, together with additional values of which it is composed and which classify it, in the selected section of the record space of the account card.

The drawing shows one illustrative form of the invention.

In the drawing,

Fig. 1 is a vertical section of a portion of the machine showing the sensing and transmitter mechanism and parts of their driving and adjusting means;

Fig. 2 is a diagrammatic plan view of one of the switch assemblies of the transmitter mechanism corresponding to one place of the plural digit numbers to be sensed;

Figs. 3 and 3*a* are punched diagrams;

Fig. 4 is a vertical sectional view showing the registering mechanism in side elevation, its driving means and appurtenant control devices;

Figs. 5*a* and 5*b* are two complementary parts of a vertical sectional view showing the record sheet table and its feeding and return mechanism in side elevation;

Fig 6 is a vertical section on the line 6—6 of Fig. 5*b*;

Fig. 7 is a vertical section of one end of the record sheet table showing a sheet clamp and its control means;

Fig. 8 is a vertical sectional view showing in side elevation a relay operated stepping mechanism for a cam shaft controlling the sensing, record sheet checking, and table feeding procedures;

Fig. 9 is a diagram of circuits and cams for control of the sensing, record sheet checking, and table feeding procedures;

Fig. 10 is a developed diagram of the control cams shown in Fig. 9.

Fig. 11 is a plan view of the upper portion of a record sheet, in this case an account card;

Figs. 12*a* and 12*b* are complementary parts of a circuit diagram of the machine;

Fig. 13 is a vertical sectional view showing in side elevation a rotary driver operating the driv-

ing means shown in Figs. 1 and 4, together with its controlling devices;

Fig. 14 is a diagram of a slide switch forming part of the transmitter mechanism;

Fig. 15 is a diagrammatic plan view indicating the relative positions of the record sheet table, sensing mechanism, punching mechanism, and printing mechanism;

Fig. 16 is a vertical sectional view showing in side elevation one of the selector switches of the comparing mechanism, its stepping means and returning means;

Fig. 17 is a vertical sectional view showing in side elevation mechanism for printing a second record sheet on a typewriter carriage;

Fig. 18 is a vertical section showing the printing mechanism for printing on the record sheet on the table shown in Figs. 5*a* and 5*b*;

Fig. 19 is an exploded view of a switch mechanism for cutting out the transmitter;

Fig. 20 is a wiring diagram showing a switch arrangement for transferring the control of the printing mechanism from a setting mechanism to a balance mechanism;

Fig. 21 is a vertical sectional view showing in side elevation a control lever for actuating the switching devices shown in Figs. 19 and 20;

Fig. 22 is a circuit diagram of a relay operating an abutment for guiding the record sheet to approximately correct position on the table;

Figs. 23*a* and 23*b* are complementary parts of a vertical sectional view showing a carriage providing for the lateral movement of the table, and its feed and return mechanism;

Fig. 24 is a detail side elevation of the record sheet abutment;

Fig. 25 is a vertical sectional view showing in side elevation the punching device.

The construction of the illustrative machine here disclosed is the following:—

The sensible indicia of the record sheets used in the illustrative machine are, as usual, in the form of perforations. The punch field may be divided into any desired number of decimal places, for instance ten, only seven being shown in Figs. 3 and 3*a*. In each place there are points for five punches, and these can be taken singly, to represent the digits up to 5, and in pairs, to make the values 6 to 9, zero being represented by the absence of any punch. In Figs. 3 and 3*a* the punch points are represented by open circles and those which have been punched by filled circles. Fig. 3 shows the field for the value 0000000 and Fig. 3*a* for the value 60000.

A set of five sensing bars **2** (Fig. 1) is provided for each place of the punch field, these bars being guided for movement perpendicular to the record sheet table **120** by their slots **2***b* sliding on cross rods **2***c*, and by combs **2***d*, and being urged downward by springs **2***e*. Each bar is provided with a sensing point **2***a* adapted to enter the punch of the record sheet **3** (Fig. 11) lying opposite it. In the position of rest of the bars downward movement is prevented by noses **4** projecting from the bars, which rest upon a rockably mounted bail **5** extending transversely to the bars. The bail **5** is articulated to a connecting bar **6**, the upper part of which is pivoted to a two-armed lever **7**. A spring **6***a* secured at its upper end to the connecting bar by a pin **6***b* and at its lower end to a stationary pin **6***c* acts constantly upon the bail **5** and the two-armed lever, urging the lever to turn in clockwise direction. A roller **8** mounted on the free arm of lever **7** coacts with a cam disk **9**. The lever **7** is mounted on a stationary shaft **7***a*. The cam disk **9** and another cam disk **10** are fastened to a shaft **11**, for example, by pins. The cam disk **10** is adapted by its nose **12** to operate rollers **13** and **14**, which are respectively mounted upon a lever **15** and a bail **16**. The lever **15** and the bail **16** are fixedly mounted, respectively, upon shafts **17** and **18** rockably supported in the machine frame. A connecting bar **19** joins the lever **15** in the manner of a connecting rod to a second lever **20**. The lever **20** and another lever not shown are fixed upon a shaft **21** and between them they carry a round crossbar **22**. The lever **15** and the bail **16** are so influenced by a spring **16***a* that their rollers lie constantly upon the cam disks **9**, **10**.

Beside the sensing mechanism is a transmitter mechanism comprising slides **24**—**28** (Figs. 1 and 2) bearing, respectively, insulated contact pieces **33/34**, **35/36**, **300/301**, **37/38**, **39/40**. These contact pieces coact, in the manner shown in the diagram, Fig. 2, with stationary spring contacts **41**, **42**, **43/44**, **45**, **46**; **47**, **48**, **49/50**, **51**, **52**; **53**, **54**, **55/56**, **57**, **58**; **59**, **60**, **61/62**, **63**, **64**; **65**, **66**, **67/68**, **69**, **70** (Figs. 2, 12*a*, 12*b*). In this way two spring contacts are always in connection with each slide contact. The slides and contacts are arranged in assemblies, one assembly being allotted to each place of the sensing mechanism. Fig. 2 shows one assembly and Figs. 12*a* and 12*b* show the five assemblies allotted to the decimal places 5—4—3—2—1. The spring contacts of alternate slides are arranged alternately above and below, as shown in Fig. 1, on account of space requirements, and within each assembly are connected to each other by conductors in the manner shown in Fig. 2. The setting of the members in Fig. 2 represents the position of rest and zero position of the transmitter slides, while Fig. 1 shows them in adjusted position. Additional connections to the spring contacts of the transmitter assemblies for the purpose of transmitting the values held in them will be explained in detail later.

The slides **24**—**28** are set or adjusted by the bail **16**, under the control of the sensing bars **2**. Each slide has pivotally connected to it a link **29** coupled by a pin and slot connection **31**, **30** with the corresponding sensing bar **2**. From each link **29** extends a tongue **32** which is moved down into the path of the bail **16**, when the pin **2***a* of its bar **2** drops into a punch in the record sheet. The slides are returned to zero position by the crossbar **22**, which engages behind tongues **23** on all the slides and moves to the left any slides that have been adjusted.

Means are provided to drive the shaft **11** (Fig. 1) through one revolution to cause an operation of the sensing mechanism and adjustment of the transmitter. On shaft **11** (Fig. 13) are fixed a lever **71** and a coupling disk **72**. Beside these there is mounted on the shaft **11** in rotatable but not axially shiftable manner a gear **73**, upon which is pivoted a pawl **74**. The pawl, which is constantly urged by a spring **2000** in clockwise direction upon its pivot, is adapted to engage in a notch **75** of the coupling disk **72**, when the curved end of a rockable lever **76** is moved out of the path of the revolving pawl. A thrust bar **77** connected to lever **76** and guided by a pin and slot connection **77***a*, **77***b*, is adapted to be operated by the armature **78***a* of an electromagnet **78** (Figs. 13, 9). In this case a notch **79** of the thrust bar **77** moves into the range of a pawl **80** which is mounted above it and urged by a spring **80***a* so that its tooth engages in the notch **79**. Upon the free arm of the pawl **80** operates a pin **81** of

a two-armed lever **82** rockably mounted on the machine frame. The lever **82** is held in position of rest by a spring **82***a* constantly against a stationary pin **83**. The free arm **84** of the lever lies in the path of a pin **85** extending out from the arm **71**. The gear **73** meshes with a pinion **86** of the drive shaft **87**, and is thereby constantly rotated when the machine is set in operation.

When the record space of the record sheet (Fig. 11), or one side of the sheet, has been completely filled, an "exhaust" perforation **88***a* is punched in it. There is an additional sensing bar for sensing this exhaust perforation and an additional transmitter slide **88** (Fig. 14) governed by it. This transmitter slide has non-conductively secured to it contact plates **91**, **92**, which stand, in the normal position of the transmitter slide **88**, in electrical connection with spring contacts **93/94**, **95/96**, respectively, the contact plates and spring contacts together constituting two switches **89** and **90** (Fig. 9). The purpose of the mechanism controlled by the exhaust perforation, the operation of which will be described presently, is to interrupt the normal sequence of operations of the machine and to restore it quickly to position of rest, so that the record sheet can be turned over, if one side is exhausted, or replaced by a new sheet.

To shaft **11** (Figs. 4, 1) is rigidly secured an additional gear **97**, which is in mesh with a gear **98** fixed upon a shaft **99**. Also secured to the shaft **99** are cam disks **100**, **101**. The cam disk **100** is adapted, by its nose **102**, to close successively contacts **103** and **175** (Figs. 4, 9). The cam disks **101** act upon rollers **104** carried by two-armed levers **105** pivotally supported in the machine frame, only one of the levers being shown. These levers engage, by pin and slot connections, **105***a*, **105***b*, slides **106** guided by pins **106***a* in slots **106***b* for movement perpendicular to the record sheet table **120**. The slides bear similar tapered justifying pins **107**. The justifying pins are so arranged that they can enter the justifying holes **108** of record sheet **3**. Springs **109** urge the lever **105** constantly in clockwise direction. Armatures **111** of electromagnets **112** (Figs. 4, 9) normally lie in front of noses **110** projecting from levers **105**, these armatures serving to prevent undesired oscillations of the levers **105** in clockwise direction. Upon a nose projecting from one of the slides **106** rest the movable arms of two spring contacts **114**, **115** (Figs. 4, 9), which are held open in the position of rest of the slide **106** (only the contact **114** is visible in Fig. 4). The contacts **114** and **115** control the further operation of the machine, which is therefore dependent upon proper justification of the record sheet.

The record sheet **3** (Fig. 11) is so placed upon the record sheet table **120** (Figs. 5*a*, 5*b*), for bookkeeping operations and the like, that it is held by an abutment **3005** (see also Figs. 24, 6) with its justifying holes **108** in the range of the justifying pins **107** (Fig. 4). The abutment **3005** is formed as a part of the armature **3010** of an electromagnet **3002** (Figs. 22, 24). The electromagnet is connected through two switches **3003**, **3004** (see also Figs. 5*a*, 5*b*), inserted in series, to the positive conductor of a source of current. As long as electromagnet **3002** is excited the abutment **3005** stands in operative position. When the table **120** is in starting position, a nose **3011** operates switch **3003** and holds it closed. On the other hand, switch **3004** is opened when the armature of an electromagnet **172** (Fig. 5*b*) is attracted. This electromagnet **172**, which serves to condition a line-selector mechanism governing the record sheet-feeding mechanism, will be described in more detail later.

The record sheet table can be fed line by line by means of an escapement mechanism **121** (Figs. 5*a*, 6) and a spring motor **122**. The belt **122***a* of the spring motor is connected to a pin **122***b* near the right end of the table (Fig. 5*b*) and draws the table toward the left. A rack bar **120***a* on table **120** meshes with a pinion **137***a* fixed on a shaft **137***b* rotatably mounted on center points **137***c*. The shaft **137***b* has also fixed to it a ratchet wheel **137** which coacts with the escapement dogs **135***a*, **135***b* of a rocking plate **135**. The plate **135** is rockably mounted by a shaft **135***c* and is urged in clockwise direction (Fig. 6) by a spring **135***d*. An arm **135***e* of the plate **135** is connected by a link **136***a* to the armature **136***b* of a relay **136**, which operates the escapement mechanism. The throw of the escapement dogs is limited by a set screw **135***f*. The return of the table is carried out directly by the machine drive. For this purpose there is provided adjacent the table a chain drive, the chain **124** of which circulates once for each two return movements of the table. The chain therefore has two similarly arranged lugs **125** (Figs. 5*a*, 5*b*, 23*a*), which are adapted to coact successively with a lug **126** on the table in successive return movements of the table. The rear shaft **127** of the chain drive carries, in addition to the sprocket **123**, a smaller pinion **128**, which meshes with a gear **129**. The latter is rotatable upon the shaft **130** of a revolving arm **131**, but held against axial movement on the shaft. The construction of the rotary driver **131** and its operation correspond with the rotary driver shown in Fig. 13. The spring-influenced pawl **132** on the gear **129** is adapted to be prevented from engaging in the notch **134** of a coupling disk **134***a* fixedly secured to the shaft **130**, by a round ended lever **133** which may be rocked by a mechanism similar to that controlling the lever **76** (Fig. 13), operated by an electromagnet **363** (Fig. 12*b*).

Along the left side of the table **120** a shaft **138** (Fig. 6) is rotatably mounted on the table. This shaft has two clamp fingers **139** rotatably mounted upon it in the range of an account card placed upon the table, the clamps being not axially displaceable on the shaft. Each clamp finger is influenced by a strong spring **140**. In the range of each of the clamp fingers there is non-yieldably fixed upon the shaft a cam finger **141**. In the same way there is fastened upon the shaft **138** a lever **142**, having a rectangularly positioned tongue upon which is mounted a roller **143**. Above this roller engages, in the starting position and position of rest of the table **120**, a tooth **144** of a pawl **145** (Figs. 5, 7) mounted upon the table and influenced by a spring **145***a* in clockwise direction. The free arm **146** of the pawl can be operated by the pin **149** of a lever **150** rockably mounted on the machine frame. The lever **150** is adapted to be rocked in clockwise direction, against the action of its spring, by an electromagnet **151** (see also Fig. 9). The roller **143** of lever **142** (Figs. 7, 6, 5*b*) can ride upon an inclined plane cam surface **152** of a lockable bell crank lever **153**. A spring **153***a* operates in counterclockwise direction upon the bell crank lever. The free arm of the bell crank lever can be prevented by a pin **154** of a locking lever **155**, which is likewise rockably mounted in the machine frame, acts upon the free arm of lever **153** to

prevent it from executing a clockwise rocking movement under the influence of the thrust to the right of roller 143 against cam surface 152. A spring 156 brings the arm 157 of the locking lever against a stationary pin 155a on the machine frame, when it is not positively actuated in another manner. In this position the pin 154 of the locking lever 155 stands in front of the free arm of the bell crank lever 153 (Fig. 7). A pin 158 which is mounted upon a cam plate 159 of the table, is adapted to coact with the arm 157 of the locking lever and to move its pin out of the path of movement of the bell crank lever 153. The cam plate 159 influences a double-acting switch 160 (Figs. 5b, 9), the contacts 161, 162 of which are closed in the position of rest of the table. As soon as the carriage leaves the position of rest the said contacts are opened and the contacts 161, 163 are closed.

Over the table 120 there is provided in the range of the filled-line perforations 165 of the account card 3 (Figs. 11, 15) a line-selecting contact brush 164 (see also Fig. 9), which is displaced by one line space from the sensing mechanism 170 and its feeler prongs 2a. The line-selecting brush therefore is positioned, in the starting position of the table, when the card is properly justified, over the filled-line punch point of the first line. The line selecting brush 164 is fastened non-conductively to a bell crank lever 171 rockably mounted on the machine frame, which is constantly influenced by a spring 171a to rest against the inner face of the armature 172a of an electromagnet 172 (Figs. 5b, 9).

The punching mechanism 172, 173a (Fig. 15) and the printing mechanism 174 in the illustrative example shown, are displaced by five line spaces from the sensing mechanism 170, on account of space requirements. Mechanisms of this kind are disclosed in Pierce Patents Nos. 1,761,741 and 1,260,704, and also in the Hollerith punched card machines.

The previously mentioned switches 114, 115 are directly connected to the positive wire 176 (Fig. 9). The moving contacts of these switches are constantly connected, respectively, with switches 89, 90. The moving contact of switch 90 is connected by a conductor 177 to the electromagnet 151 for releasing the card clamp fingers and through the latter to the negative conductor 182. A conductor 178 going out from the moving contact of switch 89 leads to a switch 175 (see also Fig. 4), the other contact of which is connected by a conductor 179 to the electromagnet of a relay 1800. Also connected to the relay 1800 are normally open switches 180, 181, which will be more fully explained presently. The moving contacts of these latter switches are connected to each other by a conductor 183 leading to the positive side of the source of current. To this conductor there are also connected contacts 184, 185, 186, and 386. Mounted on the drive shaft is a cam disk 197 which, at each rotation, closes a switch 195 of an impulse generator 196. The movable contact of switch 195 is connected to the positive conductor 176 and the other contact to one contact of a switch 188 operated by relay 1800. The other contact of switch 188 is connected to electromagnet 189 (see also Fig. 8) which operates a stepping mechanism for the progressive rotary feed of a cam shaft 204 bearing the cams 200—203, 205 (Fig. 9). Also connected to the switch 188 is a switch 187, mechanically connected with switch 180, the other contact of switch 187 being connected to electromagnet 136 (see also Fig. 6) which operates the escapement for the table feed movement. Also connected to the electromagnet 136 is a counter contact 190 for the line-selector brush 164, which is connected to the impulse generator switch 195. Switches 184 and 185 are connected, respectively, to electromagnets 172 and 78. To the contact 162 of the double-acting switch 160 are connected the electromagnet windings 112 (see also Fig. 4). The other ends of the windings of the electromagnets 78, 172, 136, 189, 1800, 112, 151, are all connected to the negative conductor 182. The electromagnet 78 which controls the rotary driver of the shaft 11 (Fig. 13) is also connected to a contact 209, which can be closed by means of a key 210 connected to the positive conductor. The contacts 181/184, 185, 187/180, 186/386, are controlled by the cam disks 200 to 203, which are rigidly mounted upon shaft 204. The cam disk 205, likewise fastened upon the shaft 204, is adapted, by its diametrically opposite raised portions 600, 601, to operate contacts 206, 207/208, 384, which are open in the position of rest of the machine and will be described in more detail presently, as well as a contact 376, which is closed in the position of rest of the machine. The operating diagram shown in Fig. 10 shows the development of the corresponding half-circumference of the cam disks and indicates the time of their operation. The second half-circumference is the same as the first and becomes operative in the following bookkeeping operation in the same way.

A setting mechanism is provided, composed of a number of selectors 325 to 329 (Figs. 12a, 12b) corresponding to the number of places of the transmitter mechanism. Each selector of the setting mechanism comprises a selector arm and a number of contacts 315—324 corresponding to the values "0" to "9." The selectors 325—329 are connected, respectively, to the transmitter assemblies, by cables 310—314, the individual contacts 315—324 of each selector being connected respectively to the spring contacts 65, 67, 61, 55, 49, 68, 70, 64, 58, 52, of the transmitter mechanism. The selectors of the setting mechanism may be of known type, shown for example in Patent No. 1,141,348. The setting member of each place carries along through the same distance through which it travels, the selector arms 330—334 of the selectors assigned to them. The selector arms 330—334 are connected by conductors 335 to 339 with contacts 340 to 344 of a comparing selector 345. With the control arm 346 of this comparing selector are constantly mechanically, but not electrically, coupled, control arms 347, 348 of additional selectors 349, 350. The contacts 351 to 355 of selector 349 are connected, respectively, by means of conductors 356 to 360 to spring contacts 42 of the places "5" to "1" of the transmitter mechanism. The supplementary contacts 361, 362 of selector 345 are individually short-circuited to the corresponding contacts 363, 364, of selector 349. The control arm 348 of selector 350 is adapted to cooperate with five contacts, that is, a number corresponding to the number of places of the setting mechanism, these contacts 365 to 369 being mutually short-circuited; also with two supplementary contacts 370, 371. The contacts 365 to 369 are connected by a conductor to a relay 373 adapted to close a pair of switches 374, 375. The switch 374 is connected in series with switch 208 (see also Fig. 9) between the positive conductor and an electromagnet 383, which is

adapted to control the lever 133 shown in Fig. 5*a*. The switch 375 is connected in series with switch 376, appurtenant to the cam disk 205 (Fig. 9), between the positive conductor and an electromagnet 377 (Figs. 12*a*, 16). In parallel to this latter circuit is a circuit through contact 371 of selector 350. In Fig. 12*b* the switches 206, 376, mechanically controlled in unison, are shown in the position they assume when a machine operation has started and are so arranged that, upon being shifted by cam 205, the switch 376 closes before the switch 206 opens. The contact 370 of selector 350 is connected by a conductor 378 to a relay 379, which also is adapted, upon excitation, to close two switches 380, 381. The switch 380 is connected in series with the switch 206 and ensures constant current supply to the relay 379. The other switch 381 is connected in series with switch 207 (Figs. 12*b*, 9) between the positive conductor and an electromagnet 382. An additional switch 384 (Figs. 12*b*, 9) mechanically controlled in unison with switches 207, 208, is connected in series with an electromagnet 385 between the positive and negative conductors of the supply main. An additional switch 386 mechanically connected to the contact 186 controlled by the cam disk 203 (Fig. 9) is connected in series with an electromagnet 387, to be described in detail with reference to its manner of operation, between the positive and negative conductors. Switch 186 and a rotary step electromagnet 388 (Fig. 12*a*) are arranged in the same way. The positive conductor also leads to the switch 389 of an impulse generator 390, the cam disk 391 of which is fixed to drive shaft 392, which rotates continuously when the motor is switched on. The movable contact of switch 389 is connected by a conductor 393 to the selector arm 346 of the selector 345. The selector arm 347 of selector 349 is connected to the conductor which joins the switch 186 to the rotary step electromagnet 388. The selector arm 348 of the selector 350 receives current directly from the positive side of the line. The selector arms 346, 347, 348 (Figs. 12*a*, 16), are advanced stepwise by the rotary step electromagnet 388. Upon that shaft 394 which carries the selector arms is fastened a pinion, which is constantly in mesh with a rack bar 395 guided by a pin and slot mounting. The rear end 396 of rack bar 395 lies in the path of movement of the pin 397 of a lever 398, which is pivotally supported on the machine frame and coupled by a parallel crank movement to a similarly mounted lever 399. A pawl 400 on lever 399 has a pin 401 projecting from its arm, which stands in front of the armature 377*a* of the previously mentioned electromagnet 377 (Figs. 16, 12*a*). The pawl 400 is constantly urged in clockwise direction by a coil spring (not shown). The tooth of pawl 400 is adapted to engage with a step 402 of a sector 403 mounted to swing back and forth, and to take part in the movement of this sector in the direction of the arrow 404. The sector 403 may form a part of an oscillating crank mechanism, as shown in Fig. 16, which need not be described in detail. The attracted position of the armature 377*a*, which is influenced by a relatively strong spring 377*b*, causes the pawl to move into operative position.

The electromagnet 382 (Fig. 12*b*) serves in known manner to carry out the stepwise advancement of the selector arm 405 of a printing selector 406, whose contacts 407 to 411 are connected by a cable 412 to 416 with the conductors 335 to 399. The selector arm 405 is connected to the conductor 393. All selector arms of the selectors 330—334, 345, 349, 350, 406 stand, in position of rest, one step before the first contact of their series of contacts. The stepping electromagnet 382 of selector 406 is connected by a disconnectable conductor 417 and parts 584, 583, 417*a*, to be described in detail later, in series with the electromagnets 418 to 427 of one or more printing mechanisms 428 (Figs. 17, 12*a*). In the foregoing illustrative example the second printing mechanism 550 (174, Fig. 15) is connected to another rotary step electromagnet 572. The printing mechanism 550 may, however, also be separated from electromagnet 572 by a simple switch and connected to the magnet 382. The electromagnets 418 to 427 are used in each printing mechanism, or the like, in a similar manner. These electromagnets are respectively assigned to the numbers "9" to "0" and each operates independently upon a lever chain 429 to 432, at the end of which the corresponding type lever 433 is located, which is adapted to print upon the journal 435, or the like, supported on the platen roller 434. The armatures 551 assigned to the printing mechanism 550 (Fig. 9) for printing the account cards on the table are formed as bell crank levers, the other arms of which are connected by pin and slot connections with the type levers 552 and are held in position of rest by springs 553.

The card table 120 rests upon a carriage 1200 (Figs. 23*a*, 23*b*), which can be moved transversely to the movement of the card table 120 in a direction parallel to the lines, by decimal places, by means of a conventional escapement mechanism 3200. The return of the carriage 1200 can be carried out by a mechanism similar to that used for the table 120 (Figs. 5*a*, 23*a*). A pin 850, corresponding to the pin 85 of the rotary driver shown in Fig. 13, forms a part of the rotary driver 3015 of the chain drive 1230 for the carriage 1200, and is arranged to close a contact 3013 (Fig. 23*a*) momentarily, shortly before the completion of one revolution. Then the coupling member 126 of the card table is again in the range of movement of the chain element 125 projecting from the chain drive 123. The closure of contact 3013 results in the engagement of the rotary driver 132, 134*a* for the chain drive 124 (Fig. 5*a*). The card table 120 is then returned to starting position.

The electromagnets 418 to 427 are connected to switches 436 to 445, the free parts of which are secured in electrically non-conductive manner to a switch bar 456. The moving contacts of switches 436 to 445 are connected by conductors 445 to 455 with the conductors of the cables 310 to 314 corresponding to the respective values "9" to "0" of all places of the indicating and setting mechanism. The switch bar 456 has two notches 457, 458, in which a retaining spring 459 may enter alternatively. In the position of rest of the machine the spring 459 lies in the notch 457 of switch bar 456. The contacts 436 to 445 are then opened. The armatures 387*a* and 385*a* of the electromagnets 387 and 385 coact alternately with the two end faces of the switch bar 456. To the printing machine 428 (Fig. 17) is operatively connected a tabulator mechanism. A mechanism of this kind for example is disclosed in Thieme Patent No. 1,027,225. In this construction the tabulator levers are operatively connected with a switch 2327. Said switch is combined with a electromagnet 2329 (Fig. 17,

23*a*) which over parts 2330, 3200 controls in a manner indicated before the lateral tabulating movement of the account card.

The operation of the machine is as follows:—

At the beginning of the bookkeeping operation the record sheet 3, in this case an account card (Fig. 11), is laid upon the card table 120 (Fig. 5) and pushed up to the abutment 3005 (Figs. 5*a*, 6, 24). Then the key 210 (Fig. 9) is pressed, so that the switch 209 is closed. Thereby the electromagnet 78 (Figs. 9, 13) receives a current impulse momentarily. It attracts its armature and throws the shift bar 77 in the direction of the arrow far enough to allow the tooth of pawl 80 to drop into the notch 79 and swings the lever 76 out of the path of movement of the revolving pawl 74 until a further change occurs. In this way the tooth of pawl 74 springs into the notch 75 of the coupling disk 72. The coupling disk, and with it the shaft 11 as well as the arm 71 and the cam disks 9, 10, 100, 101 (Figs. 1, 4), now take part in the revolution of the pawl 74. Immediately at the beginning of the rotary movement the nose 12 of cam disk 10 operates the roller 13 of lever 15 and displaces the latter in clockwise direction. By means of the coupling bar 19 the lever 21 and crossbar 22 are made to execute the same movement. Thereby the crossbar 22 engages the tongues 23 of those transmitter slides which were adjusted in the previously finished bookkeeping operation and moves the latter back into zero position. At the same time as the cam disk 10 becomes operative the cam disk 101 releases roller 104 of bell crank lever 105, which can then rock in clockwise direction, because the electromagnet 112 has been excited from the beginning through the circuit 176, 161, 162 (Fig. 9). Thereby the justifying pins 107 move down into the justifying holes 108 of the account card 3 and bring the latter into the correct position. At this time the nose 113 of one of the slides 106 allows the contacts 114, 115 (Figs. 4, 9) to close. As soon as this has occurred the raised portion of the cam disk 9 releases the roller 8 of lever 7, whereupon the latter, following the pull of the spring 6*a* of coupling bar 6, executes a clockwise swinging movement. The bail 5 (Fig. 1) is thereby displaced in the direction of the arrow and releases the noses 4 of the sensing bars 2. The latter then drop, aided by their springs, until they are arrested by the account card 3. If there are holes in the account card in the path of the feeler pins 2*a*, the feeler pins enter these holes and thereby swing the links 29 of the transmitter slides 24—28 connected to them, until their tongues 32 enter the path of movement of the bail 16. Then the nose 12 of cam disk 10 acts upon the roller 14 of bail 16 and swings the latter counterclockwise for such a distance that it engages the tongues 32 of links 29 in its path and shifts the transmitter slides so that their contacts plates come into contact with the spring contacts 43, 46, or the like, which up to that time were disconnected.

In the foregoing example these operations of the transmitter mechanism do not occur, because, in accordance with the account number "00000" at the head of the account card none of the punch points is punched, as indicated in the punch diagram (Fig. 3). Consequently no sensing pins 2*a* of the sensing bars 2 can enter corresponding holes of the account card, so that the transmitter slides 24 to 28 of all places remain in the zero position shown in Figs. 2, 12*a*, 12*b*.

Simultaneously with the sensing of the punch points of the account number of the account card (Fig. 11), an additional feeler pin 2*a* previously described, comes into engagement with the punch point 88*a* for the exhaust perforation of the card. If the card at this place is not marked "exhausted" by any perforation, the contacts 89, 90, remain in the position of rest shown in Fig. 14. However, if the feeler pin 2*a* is able to enter an exhaust perforation 88*a*, thereafter the switches 89, 90, are opened (see also Fig. 9). If there is no exhaust perforation 88*a* when the nose 102 of the revolving cam disk 100 comes into engagement with the auxiliary contact 500 (Figs. 4, 9) and closes it, current flows through the contact 115, closed at the beginning of the revolution, and through the parts 90, 500, to electromagnet 151 (Figs. 9, 5*b*). If there is an exhaust perforation 88*a* the switches 89, 90, are opened, so that the described circuit remains unoperative. But even when there is no account card, or the like, inserted, there is no excitation of electromagnet 151, because in such a case the contacts 114, 115 remain open. After the completion of the revolution under these conditions the card which has been punched "exhausted" to prevent the recording of additional entries can be removed from the card table and another card laid upon it.

The excited electromagnet 151, by its armature 151*a*, swings the lever 150, which so displaces the pawl 145 through the action of its pin 149 that the tooth 144 of the pawl releases the roller 143 of lever 142 (see also Fig. 6). The clamp finger 139 resting upon cam 141 is now able to follow the pull of its spring 140 and to come to rest on the account card 3. The roller 143 of lever 142 then assumes the position shown in Fig. 7.

The cam disk 100, which has been turning in the meanwhile and continues to turn further, now closes the contact 175 (Figs. 4, 9), by its nose 102, shortly before the cam disk 9 (Fig. 1) acts by its raised part upon roller 8 and thereby swings the lever 7 in counterclockwise direction, so that by the action of the bail 5 upon the noses 4 the sensing bars 2 lift the sensing pins 2*a* from engagement with the account card 3.

Meanwhile the pin 85 (Fig. 13) of the revolving arm 71 swings lever 82 counterclockwise. In this movement the pin 81 has carried with it the pawl 80 and raised the tooth of the pawl out of notch 79 of thrust bar 77, so that the latter and with it the lever 76, again assume the position of rest. The pawl 74, which in the course of its movement travels past lever 76 is deflected by the latter and its tooth is moved out of the notch 75 of the coupling disk. At this instant the rotary movement of cam disks 9, 10, 100, 101 (Figs. 1, 4) is interrupted. They have now again assumed their positions of rest. Thereby the justifying pins 107 have again been moved out of the justifying holes. The armatures 111 of electromagnets 112 again move in the blocking position in front of the noses of bell crank levers 105.

The closure of contact 103 by the nose 102 of cam disk 100 shortly before the latter comes to rest has no effect, because the contact 103 receives no current through the double-acting switch 160 (Figs. 9, 5) in the starting position of the card carriage. Since the nose 12 of cam disk 10 operatively influences the roller 13 only once in the course of its revolution—that is, only at the beginning of its revolution—the transmitter slides 14—28 are not displaced from their

set position, if any of them have been moved according to a number higher than "0."

The contact 175 (Figs. 9, 4) described above, which is closed by the nose **102** of cam disk **100**, receives current during that period which lies between the return of the sensing pins *2a* and the beginning of the withdrawal of justifying pins **107** from the justifying holes **108** of the account card 3 (Fig. 11). Accordingly a current impulse flows through the circuit **176, 114, 89, 178, 175, 179**, to the relay **1800** and the negative conductor. By the succeeding closure of switch **195** of the impulse generator **196**, a current impulse passes through switch **188** to the rotary step electromagnet **189** (Figs. 9, 8). The latter attracts its armature **189*a*** momentarily and by the ratchet drive **189*b*, 189*c***, controlled by the latter, moves forward for one step the shaft **204** bearing the cam disks **200** to **203** and **205**. Thereby the nose **601** of the cam disk **205** moves away from switch **206** (Figs. 9, 12), so that the latter closes, while the raised portions of cam disks **200, 203** (Figs. 9, 10) close the switches **181/184, 186/386**, whereby the following operations take place:

From the positive conductor **183** (Fig. 9) the current flows through switch **386** to the electromagnet **387** (Fig. 12) and then to the negative conductor. The electromagnet **387** attracts its armature **387*a***, which operates the switch bar **456**, so that the notch **458** thereof is displaced from detent spring **459** far enough to allow the latter to enter the notch **457**. The switches **436** to **445** are thus opened, until further operation of the switch bar, so that the electromagnets **418** to **427** of the printing mechanism cannot be influenced.

Furthermore, a continuous current is supplied through the connection provided by the parts **183, 181**, to the relay **1800**. Simultaneously the electromagnets **172, 388** (Figs. 9, 12) are excited by current coming through the parts **183/184, 183/186**.

By the armature **172*a*** of electromagnet **172** the contact **3004** is opened and the bell crank lever **171** bearing the contact brush **164** (Figs. 5, 9) is swung in counterclockwise direction. Thereby the contact brush **164** engages the field provided for the filled-line punch point "one" (**511**), at the level of the first line **510** of the account card **3** (Fig. 11), and so, by passing through the line punch **511**, comes into contact with the counter contact **190**. By the opening of the contact **3004** the electromagnet **3002** is demagnetized and the abutment **3005** (Fig. 24) is withdrawn from the account card. By the following closure of the switch **195** of the impulse generator **196** a current impulse is generated which divides and passes through two circuits; first, from the positive conductor **176** through the parts **164, 190** to the electromagnet **136** (Figs. 9, 6); second, through the contact **188** of relay **1800** to the rotary step electromagnet **189** and thence to the negative conductor. The electromagnet **136** operates the line feed device **121** (Fig. 6). Hereby the card table **120** is released for a stepwise movement of one line space, under the influence of spring motor **122**, whereupon the card table arrives in the next line position (**512**—Fig. 11). The simultaneously excited electromagnet **189** (Figs. 9, 8) moves the cam disks **200** to **203** and **205** by one step further in clockwise direction, into position 3, Fig. 10. Thereby the nose of cam disk **203** again releases switches **386, 186**. They open again, while the raised part of cam disk **200** still holds the switches **181, 184** closed. It can be seen from this that the electromagnets **172** (Figs. 5, 9), **189** (Figs. 8, 9) are excited as long as the raised portion of cam disk **200** is able to act upon the switches **181, 184** in the course of its stepwise movement. This occurs during thirteen successive steps. These thirteen steps of the cam disk **200** correspond to the number of lines of one side of the account card **3** (Fig. 11). If more or less lines are provided on the account card the cam disk **200** must be formed accordingly in its raised parts. If there is a line punch **512** in the second line of the account card, another current impulse is given to the electromagnet **136**, as well as electromagnet **189**, whereby the card table **120** (Figs. 5*a*, 5*b*) and the cam disks **200, 203, 205** again move for one step in the direction indicated above. However, if there is no punch **512** at the level of the second line of the account card **3** (Fig. 11), the electromagnet **136** is no longer excited after the second line position has been reached and the card table remains in this position. This condition can evidently also occur upon sensing the first line punch point **511** of the account card **3**. In that case the card table **120** will execute no feed movement during the succeeding machine operation, the object of which is to select the line for sensing the value. In the case here illustrated it is assumed that the first five lines, down to **515**, of the account card have already received records. The card table **120** and the cam disks **200** to **203** and **205** therefore carry out four stepwise movements in the manner described, until the fifth line **515** passes under the contact brush **164**, whereupon an additional step follows, by which the punches of the fifth line **515** (balance values, debit and credit partial balance, individual postings, or the like) move under the sensing pins *2a* of the sensing mechanism (Fig. 1). In the illustrative example there have been punched a balance resulting from a new debit posting. After the next line "six," which has not been printed upon, moves with its unperforated filled-line punch point **516** under the contact brush, and the newest punched balance value 600.00 has taken its position under the sensing pins, the electromagnet **189** (Figs. 9, 8) receives several current impulses, namely, as many impulses as the step movements required to move the raised portion of the cam disk **200** out of operative relation to the switches **181, 184**; (in the illustrative example "eight"). At the time when only one step movement is necessary to separate the raised portion of cam disk **200** from the switches **181, 184**, the nose of cam disk **201** acts upon the switch **185** and closes it. Thereby current passes from the positive conductor **183** to the electromagnet **78** (Fig. 9), which is directly connected to the negative conductor. The next current impulse released through the switch **195** of impulse generator **196** then results in one step movement of the cam shaft **204**, through the excitation of electromagnet **189**, whereby the raised parts of cam disks **200, 201**, again release the switches **181/184, 185**. Thereby the relay **1800** drops, opening its switch **188**. The electromagnet **172** is likewise demagnetized and thereby brings about the return of the contact brush **164** into the inoperative position shown in Figs. 5 and 9.

The electromagnet **78** (Figs. 13, 9) momentarily excited by the action of the nose of cam disk **201** upon the switch **185**, brings about, in the manner described above, the engagement of pawl

74 in the notch 75 of coupling disk 11 and the movement of the latter through one operative revolution. Thereby the following procedures are carried out in dependence upon the cam disks 9 and 10:—

The crossbar 22 (Fig. 1) executes its normal movement serving to extinguish the setting of the transmitter slides. Then the sensing of the balance value punches of the line "five" of the account card 3 (Fig. 11) is carried out. The bell crank lever 105 remains in the position shown in Fig. 4, because it has been prevented from moving by the armatures of the unexcited electromagnets 112. Referring to Fig. 3*a*, it will be seen that in accordance with the balance value 600.00 only in place "five" from the right is the value "six" represented by a combination of punches. Now into these punches enter the sensing pins 2*a* of the sensing bars 2. Thereby the sensing bars carry down with them their appurtenant links 29. The slots 30 of the links 29 connected to the transmitter slides 24 and 28 of place "five" of the transmitter mechanism glide upon the pins 31 projecting from the sensing bars 2 as the latter move down. Thereby the tongues 32 of the two links come into the path of the bail 16, which is then displaced by the nose 12 of the cam disk 10 in counterclockwise direction. Thereby the selected links, together with their slides 24, 28, are moved from their "0" position in the direction of the arrow 520 (Fig. 1), into the position shown in Fig. 1. In this way the contact pieces 33/34, 39/40 of slides 24, 28, of place "five," move out of engagement with contacts 41/44, 65/68, and into electrical connection with the spring contacts 42—43/45—46, 66—67/69—70 (Fig. 2). In Figs. 12*a*, 12*b*, the setting corresponding to the number 60000 is drawn in dot and dash lines. In the hook-up as shown, the slide contact 35 and spring contacts 44, 45, 46, are dummies. After setting of the slides 24, 28, the cam disk 9 brings the sensing pins 2*a* back again into starting position (Fig. 1). Since in the range of the line which is being sensed there is no exhaust punch 83*a* (Fig. 11), the contacts 89, 90 remain in closed position. Shortly before the end of the revolution of the coupling disk and therewith also the cam disk 100 (Fig. 4) the nose 102 acts upon the switch 103 (see also Fig. 9) and closes the latter. Previously the card table 120 moved away from the double-acting switch 160, upon feeding to the last printed line of the account card 3, the contacts 161, 163 having been closed, while contacts 162, 161 were separated. In this way the current impulse passes through parts 176 (Fig. 9), 161, 163, 103, 179 to the relay 1800. The switch 188 of the same is thereby closed. Then from the following closure of the switch 195 pertaining to the impulse generator 196, an additional current impulse is given to the rotary step electromagnet 189 (Figs. 9, 8) through switch 188. This operates again upon the cam disks 200 to 203 and 205 and moves them in the direction of the arrow by one step. The cam disks now take the position "sixteen" (Fig. 10). In this position the cam disk 202, by its raised portion, acts upon switches 187, 180 and closes them. Hereby the relay 1800 receives current continuously. The switch 188 remains in closed position. The next current impulse of the impulse generator 196 coming through switch 195 goes through the members 188, 187 to escapement electromagnet 136 (Fig. 6), for causing a line spacing movement of the card table 120 (Figs. 5*a*, 5*b*), in the direction of the arrow 123 and through the contact 180 directly to the rotary step electromagnet 189. Thereby the card table 120 and the cam disks 200 to 203 and 205 are moved one step further. This procedure is repeated according to the extent of the distance of the printing mechanism and punch mechanism from the sensing mechanism. In the foregoing illustrative example the distance between these mechanisms equals five line spaces, or five line space movements. The raised parts of cam disk 202 acting upon the switches 187, 180 therefore cause five successive excitations of the electromagnets 136, 189. At the end of that time the new line 516 of the account card 3 (Fig. 11) to be printed upon, stands at the level of the printing and punching mechanism, while the raised part of cam disk 202 has again released the switches 187, 180. They are therefore again opened, whereby the relay 1800 again drops. The cam disks 200 to 203 and 205 are now in the position "twenty-one" (Fig. 10). At the instant when the cam disk 202 has only one step left to open the switches 187, 180 (position 20—Fig. 10), the nose 601 of cam disk 205 acts upon the switches 207, 208, 384 (Figs. 9, 12*b*) and closes them.

However, before explaining the operation resulting from this action, additional procedures (comparing procedures) going on collaterally to the card movements, are to be described. These were initiated at the beginning of the movement of cam disks 200 to 203 and 205 started by depression of key 210, by closure of switch 186 (Fig. 9). These procedures are always terminated not later than the thirteenth, or last line provided for bookkeeping has reached the sensing position, if all the higher lines have been printed upon (Fig. 11). The result of the comparison is only made effective, in the manner presently described, at the close of the entire line setting.

The impulse of current going over switch 186 excites the rotary step electromagnet 388 of the selector 345, 349, 350 Fig. 12). Thereby the selector arms 346, 347, 348, of the same run onto the first contacts next to them, 340, 351, 365. Before this, that is, before the depression of key 210 (Fig. 9) there was set up in the setting mechanism of the machine the identifying number of the desired account card 3 (Fig. 11) "00000." The selector arms 330 to 334 of selectors 325 to 329 thereby immediately took the dot and dash line position shown in Figs. 12*a*, 12*b*. As soon as the selector arms 346 to 348 of the selectors 345, 349, 350 have assumed their new positions, a current impulse comes through the switch 389 of the impulse generator 390, operated by the continuously rotating cam disk 391, which travels the following path: Switch 389, conductor 393, selector arm 346, parts 340, 335, 330, 315, 310, spring contact 65 of place "five" of the transmitter mechanism, members 39, 66, 59, 37, 60, 53, 300, 54, 47, 35, 48, 41, 33, 42, 356, 351, 347, rotary step electromagnet 388, negative conductor. At the same time the current flows through the following circuit: Positive conductor selector arm 348, contact 365, conductor 372, relay 373, negative conductor. The relay 373 now remains closed as long as the switch arm 348 remains in contact with one of the mutually short-circuited contacts 365 to 369. The electromagnet 388 now brings the selector arms 346, 347, 348 into connection with the contacts 341, 352, 366. The next impulse current thus runs through the following circuit: Switch 389, parts 393, 346, 341, 336, 331, spring contact 65 of place "four" of the transmitter mechanism members 39, 66, 59, 37, 60, 53, 300, 54, 47, 35, 48, 41, 33, 42,

357, 352, 347, electromagnet 388, negative conductor. In this way the agreement of the several places of the transmitter with the corresponding places of the setting and indicating mecchanism is tested place by place. The comparing procedure can, however, be carried out simultaneously in all places by connecting in series the contacts of the same value in the successive places, in known manner, shown for example in German Patent No. 195,310.

If, in the illustrative example, the setting of places of the same order is not in agreement—which is assumed for the third place—no suitably prepared circuit can be closed through the switch 389. The rotary step electromagnet 388 is not again excited. Consequently, according to the assumption, the selector arms 346, 347, 348 (see also Fig. 16) remain over contacts 342, 353, 367. The relay 373 remains excited. The excited relay keeps the contacts 374, 375 closed. Thereby after setting of the line 516 of the account card 3 (Fig. 11) to the level of the printing and punching mechanism and the closure of switches 207, 208, 384, current flows through parts 374, 208, to electromagnet 383, which swings lever 133 (Fig. 5a) out of the path of movement of the continuously revolving pawl 132. The manner of operation of the rotary driving member in Fig. 5 is the same as that of the rotary driving member shown in Fig. 13. The pawl 132 enters the notch 134 of the coupling disk of the rotary driving member 131 and carries the latter through 360°. Thereby the chain 124 is moved in clockwise direction, so that its lug 125 engages the cleat 126 of the card table 120 and moves the latter in the direction opposite to arrow 123a into its starting position. Thereby the roller 143 (Figs. 5 to 7) engages the control cam 152 of bell crank lever 153 and is displaced, together with its lever 142, in counterclockwise direction (Fig. 6), because the bell crank lever 153 is prevented from being deflected, by locking lever 155. Thereby the cam 141 raises the clamp fingers 139, which again release the account card 3. During its swinging movement the roller 143 moves under the tooth 144 of pawl 145 and thus is retained in the card releasing position. Directly thereafter the pin 158 of card table 120 actuates the arm 157 of locking lever 155 and brings the pin of the latter out of the path of movement of bell crank lever 153. The end surface 1000 of the bell crank lever thereby passes freely over the pin 154 of locking lever 155. The card table 120 has now reached its starting position. The active lug 125 now moves a bit further into the position shown in Fig. 5, while the second lug 125 moves into the preparatory position of the next return movement of the card table. The card which has been determined to be wrong can now be removed from the card carriage and replaced by another.

Since the bell crank lever 153 has been released, after the insertion of a new card and the rocking of pawl 145 caused by electromagnet 151, the card clamp fingers 139 (Fig. 6) can again become operative and retain the newly inserted card. Then as soon as the card table again leaves its starting position, the locking of the bell crank lever again becomes operative. Simultaneously with the attainment of the starting position (position of rest) the card table 120 also reverses the position of double acting switch 160 (Figs. 5b, 9). The electromagnets 112 are then excited in the manner described first. The switch 384 closed simultaneously with switch 208 causes the excitation of electromagnet 385 (Figs. 12a, 12b), which throws the switch bar 456 and thus closes the contacts 436 to 445. When this has occurred the retaining spring 459 springs into the notch 458 of the switch bar and holds the latter in the new position.

When the cam disk 205 (Fig. 9) again returns to starting position, its nose 600 operates the switches 376, 206, closes the former and opens the latter. Then current flows from the positive conductor through parts 376, 375, the electromagnet 377 (Figs. 12a, 16) to the negative conductor. The excited electromagnet attracts its armature, whereby pawl 400 moves so that its point comes into contact with sector 403, which then, by its swinging movement, moves its step 402 in front of the in-springing point of the pawl. The pawl 400 is thereby carried along in the direction of the arrow 404. The pin 397 is thereby caused to act upon the end face 396 of rack bar 395 and to move this, together with the selector arms 346, 347, 348, back into starting position. As soon as the selector arm 348 (Fig. 9) leaves the row of contacts 365 to 369, the relay 373 of the network is cut out and the contacts 375, 374 again open. The selector arms 346, 347, 348 (Fig. 16) and their shaft 334 can be fixed to a sector 560 bearing numbers, one number of which is always visible through a sight hole 561. Hereby upon a negative result of comparison it can be additionally determined in which place of the compared identifying number the stop precedure was released.

If the assumption that there was a disagreement in any part of the setting of the two parts to be compared, for instance, in the third place, is not true, the comparing procedure continues in the manner described for the first contact places 340—341, 351—352, up to the contacts 344 assigned to the last place, "one." If agreement is found in all places of the parts of the control devices to be compared (indicating and setting mechanism, and sensing transmitter), the switch arms 346, 347, 348 move onto contacts 361, 363, 370 of selectors 345, 349, 350. The relay 373 drops. From the positive conductor current flows through the parts 348, 370, 378, the relay 379 to the negative conductor. The relay 379 closes its switches 380, 381. Meanwhile the noses 600, 601 of cam disk 205 are out of the range of contacts 376/206, 207/208/384. The contact 206 is therefore closed. In this way current flows continuously through the parts 206, 380 to relay 379. The switches of the latter remain in closed position. The next switch step made possible by the contact connection 361/363 and the switch arms 346, 347 only brings the switch arm 348 onto its contact 371. The electromagnet 377 (see also Fig. 16) receives current and causes the return, in the manner described above, of the selector arms 346, 347, 348, and the indicating sector 560 to the starting position shown in the drawing. After the line 516 of account card 3 (Fig. 11) to be printed upon has been adjusted to the level of the printing and punching mechanism, as already described, the nose 601 of the cam disk 205 comes into engagement with contacts 207, 208, 384 and closes them. Hereby current flows through the contact 384 to electromagnet 385 (Figs. 12a, 12b), which causes the switch bar 456 to close the contacts 436 to 445. The switch bar is held in this position by the retaining spring 459 snapping into its notch 458. Also, current flows through the following circuit: Positive conductor 381, 207, rotary step electromagnet 382, negative conductor. The cam disk now again

releases contacts 207, 200, 384 and again assumes a position identical with the starting position, except that it is the nose 600 which opens switch 206 and closes switch 376. Thereby the relay 379 drops again.

The electromagnet 382 excited only for a short time moves the selector arm 405 of selector 406 one step forward in clockwise direction. Thereby selector arm 405 comes onto contact 407. The following closure of switch 389 of the impulse generator 390 now sends an impulse of current through the following circuit: Switch 389, parts 405, 407, 412, 335, 330, 315, 455, 445, electromagnet 427 of the printing mechanism 428 (printing mechanism 550 for account card 3 is switched out), 417*a*, 584, 417, electromagnet 382, negative conductor. The excited electromagnet 427 causes the printing of a zero upon the journal. The electromagnet 382 moves the selector arm 405 one step forward, so that it moves onto the contact 408. Thereby the identifying number "00000" is printed. When this has occurred, two of the combined selector arms come over its auxiliary contacts 570, 5700. Thereby two current impulses pass through parts 5700, 417*a*, 583, 584, 417 to electromagnet 382 and through conductor 571 to a rotary step electromagnet 572, which is directly connected to the negative conductor, and moves one step forward the selector arms 573, 574, of two selectors 580, 581, which are connected together mechanically but not electrically. In this way the selector arm 573 comes into connection with the first contact 575 next to it of a row of contacts 575 to 579, while the selector arm 574 coacts with the contact slide 582, which extends through the same angle as the abovementioned row of contacts. An additional selector arm 583, which is also non-conductively coupled to the selector arm 573, rests, in starting position, upon a single contact 584 and is adapted to coact with a contact slide 585 corresponding in size to the contact slide 582. To the selector arm 583 is connected the conductor 417*a*. The single contact 584 is connected to the conductor 417. The contact slide 585 is connected directly to the negative conductor of the network. The exciting of electromagnet 382 last mentioned brings the selector arms 405 into the position of rest shown in Fig. 12*a*. Upon the first step movement of the selector arms 573, 574, the selector arm 583 also moves onto its contact slide 585. The return conductor of electromagnets 418 to 427 of printing mechanism 428 is thereby disconnected from electromagnet 382 and connected directly to the negative side of the line, while the return conductor 587 of printing mechanism 550 is connected through selector 581 to rotary step electromagnet 572, which steps the selectors 580, 581, 583.

Over the selector arm 573 there now goes a current impulse from the switch 389 of the impulse generator 390 trough the following circuit: Parts 389, 393, 573, 575, 356, spring contact 42 of place "five" of the transmitter mechanism 43, 51, 36, 50, 57, 301, 56, 63, 38, 62, 69, 40, 70, conductor 310, 349, electromagnets 421, of the printing mechanisms 428, 550 (Figs. 17, 18), 417*a*/583/585, negative conductor 587/574, 582, electromagnet 572, negative conductor. The number "six" of the old balance value "60000" is printed upon the account card 3 (Fig. 11, line 516) and journal 435 (Fig. 17). The electromagnet 572 brings the selector arms 573, 574, 503 into the next position. So it proceeds from place to place, until the old balance value has been printed down upon the account card and journal. At the same time, in accordance with the copending applications of Senkel, Dueball and Sobisch, Serial Nos. 279,322 and 290,207, the transfer to the balance mechanism also takes place. Balance or accounting mechanisms are disclosed for example by USA Patent No. 1,205,298, the British Patents Nos. 5674/1915, 5675/1915, and the German Patent No. 175,357. Then the selector arms 573, 574, 583, leave the series of contacts 575, 579, and the contact slides 582, 585. Thereby the selector arm 573 comes to an auxiliary contact 590, which is connected through a conductor 591 and a switch 595 to one or more electromagnets 383 for the return controls (lever 133) of the card table 120, of the carriage 1200 on which the card table is mounted (Figs. 23*a*, 23*b*), and of the typewriter machine carriage 434 (Fig. 17). Then the return of the card table 120 into starting position in the manner previously described is only begun when the return of carriage 1200 (Fig. 23*a*) has almost ended (contact 3013). The contact 3013 is not used when punching operations occur during the bookkeeping operations, as described further below. In this way the card table 120, or the like, is returned to its starting position, in the manner already described in detail, and the account card is released for removal. The selector arms 573, 574, 583 can again assume the positions of rest shown in Fig. 12*b*. In place of the contacts of the sensing transmitters the selectors of the balance mechanism T or the setting mechanism S (Fig. 20) can be coupled selectively to the selectors 580, etc., whereby the setting of the balance mechanism and the setting mechanism can be transferred directly to the printing mechanism, as well as to aggregates corresponding to the purpose and content of the mechanism switched in (setting mechanism or balance mechanism).

It can be seen from Figs. 19 and 20 how the series of conductors coming from the selector 580 (Fig. 12*b*), namely 356 (575) to 360 (579), can be disconnected from contacts 42 of the sensing selector mechanism and connected selectively either to the selectors 325 to 329 of the setting mechanism S or of the balance mechanism T. The switch 3000 required for this purpose is controlled by a cam 4000 (Fig. 21), the three steps 4001 to 4003 of which effect the individual connection of the said two mechanisms S and T, or their disconnection. The notch of a sector 4004 forming a unit with the cam 4000 provides for the coupling of the selector 580 with the contacts 42 of the sensing transmitter mechanism, through the action of a switch 3001 (Figs. 21, 19). The setting of the cam 4000 and sector 4004 can be accomplished by a lever 4005 projecting from them.

When the new values to be posted have been set in the setting mechanism S (Fig. 20), the printing of these values and the transmission of them to the balance mechanisms is initiated by the release of a current impulse by means of a key 4010 (Fig. 12*b*). Then immediately a current flows from the positive conductor through switch 4011 to rotary step electromagnet 572 for the selectors 580, 581, etc. Before this the lever 4005 had been shifted in the direction of the arrow 4013. A prerequisite for the multiple operation of selector 580 in a single bookkeeping sequence is prevention of closure of the switch 595 while selector arm 573 is on contact 590, until the bookkeeping sequence is finished. The control means for this purpose can be constructed in accordance with Fig. 21 of the previously mentioned patent

application, Serial No. 290,207 (the adjustable rider on the paper carriage. The conductor **591** is connected to the conductor **571**. In this way the switch arm **573** can be made to return to starting position after each individual value entry without delay. After the new posting has been entered in the machine and calculated, the lever **4005** is turned in the direction of the arrow **4012** (Fig. 21) to the opposite end position. The balance mechanism T is connected to the selectors **580**, **581**, etc. By depressing the key **4010** the printing of the newly formed balance **700 00** (line **516**) on the account card and journal occurs as in the preceding posting operation. After the printing of the new balance the new balance value is also entered by punches or the like on the line of the account card for the entry, as in the example above-described, by releasing a special contact key **4200** (Fig. 12*b*). In a corresponding manner also the punching of the filled-line punch point, at the line which has just received the entry, by means of a new line punch, takes place. Since at the close of printing of the new balance the corresponding rider of the paper carriage actuates the switches **595**, (Fig. 12*b*), the electromagnets **383** for the carriage **1200** and the typewriter carriage **434** receive current. Both return to starting position. Because the machine is supposed to carry out a punching operation, the contact **3013** is not connected to the rotary driver of carriage **1200**. The card table **120** therefore remains still at the same line. Then immediately the contact key **4200** (Fig. 12*b*) is actuated closing a switch **6000**. A special rotary driver (like Fig. 13) is released for control of the punching mechanism. In this way a shaft **6001** (Fig. 25) is set in rotation. The fingers **6002** of a cam disk **6003** close a switch **6005** repeatedly in synchronism with the setting movement of the individual punch selector member **6004** and a distributor **6006**. Through the distributor **6006** current impulses pass to the places "0" to "9" of the value selectors **325** to **329** of the balance mechanism T. To the return conductors **617** to **621** of the value selectors are connected an equal number of electromagnets **6022**, which are excited when the circuits including them are closed and then hold fast the punch selector member **6004**. The latter then embody the setting of the balance mechanism T. After a half revolution of cam disk **6003** the cam disk **6023** rigidly fixed to it becomes active and operates the bail **60240**. The new balance is punched, as well as printed, on the line of the account card on which an entry has just been made. Following this the cam **6023** closes contact **6024**, which corresponds in its operation to the above-described contacts **3013** (Fig. 23*a*) and sets in operation the rotary driver for the return of the card table **120** in the manner, previously described. During the punching operation of the machine the lever **4005** (Fig. 21) stands in its middle position. For punching a new line the adjustment of the punch selector member **6004**, **8000** (Fig. 25) is controlled irrespective of electromagnets **6022** by a stationary pin **8001**.

Like the posting of new values there can also be entered other values which are not to be calculated, such as contra-account numbers, record sheet numbers, dates, etc., simply by switching or operating the above-mentioned control members to journal and account card (Fig. 11).

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PUBLISHED
JUNE 1, 1943.
BY A. P. C.

H. MÖLLER ET AL
BOOKKEEPING MACHINES OR THE LIKE
Filed July 25, 1940

Serial No.
347,464
20 Sheets-Sheet 1

Fig. 1

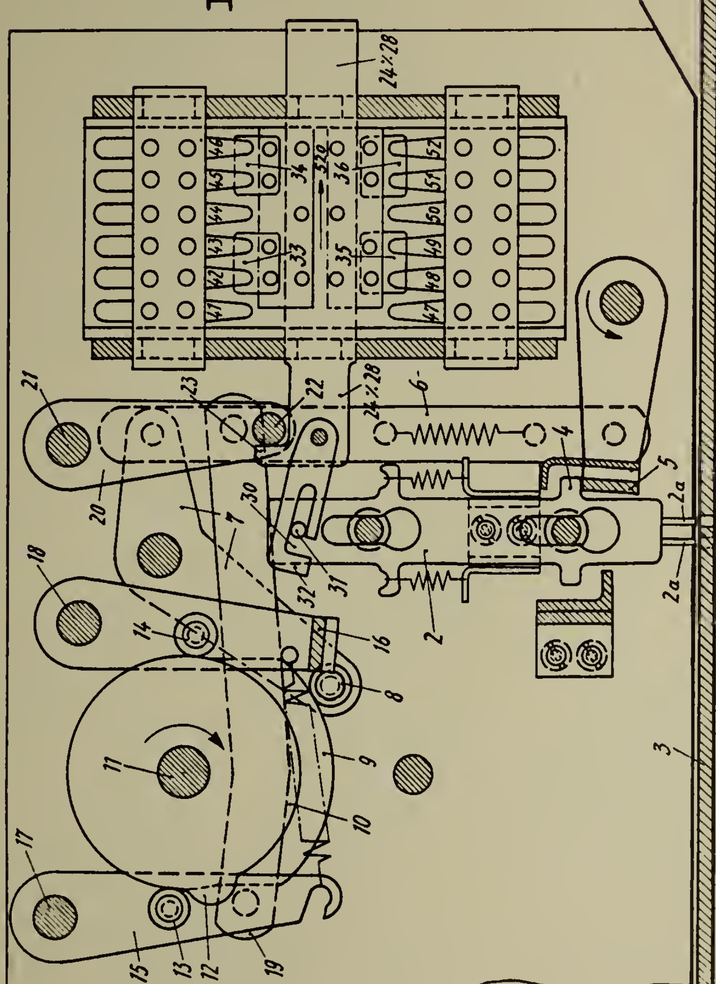

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Fig. 14

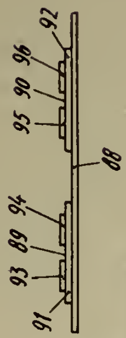
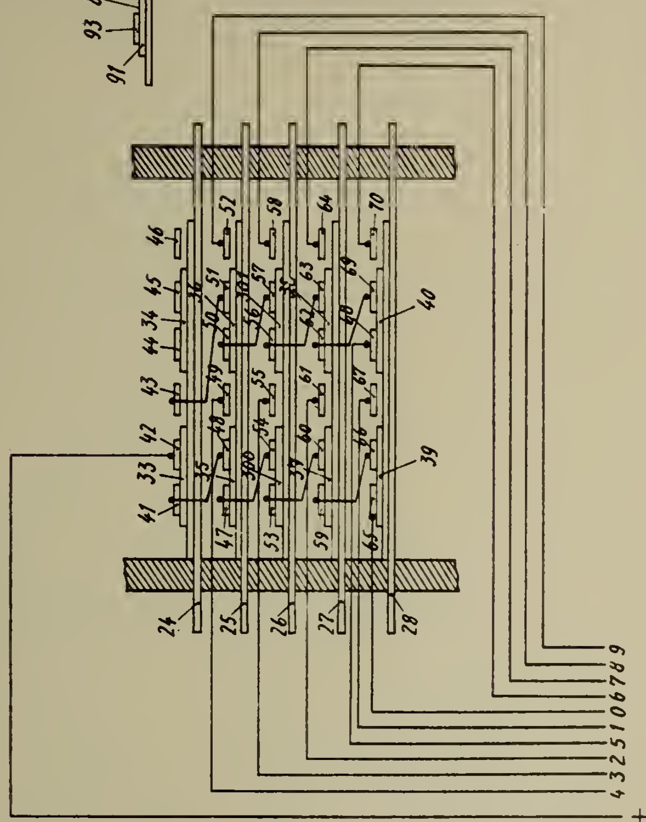


Fig. 2



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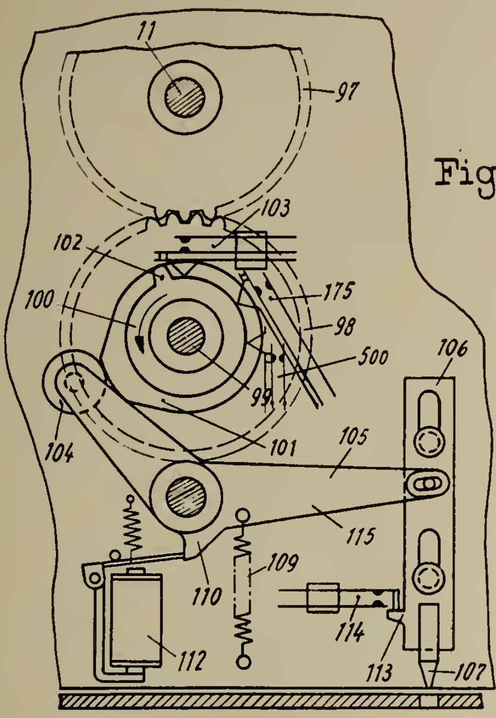

Fig. 4

Fig. 3.

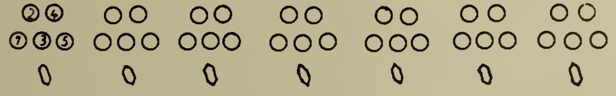

Fig. 3a.

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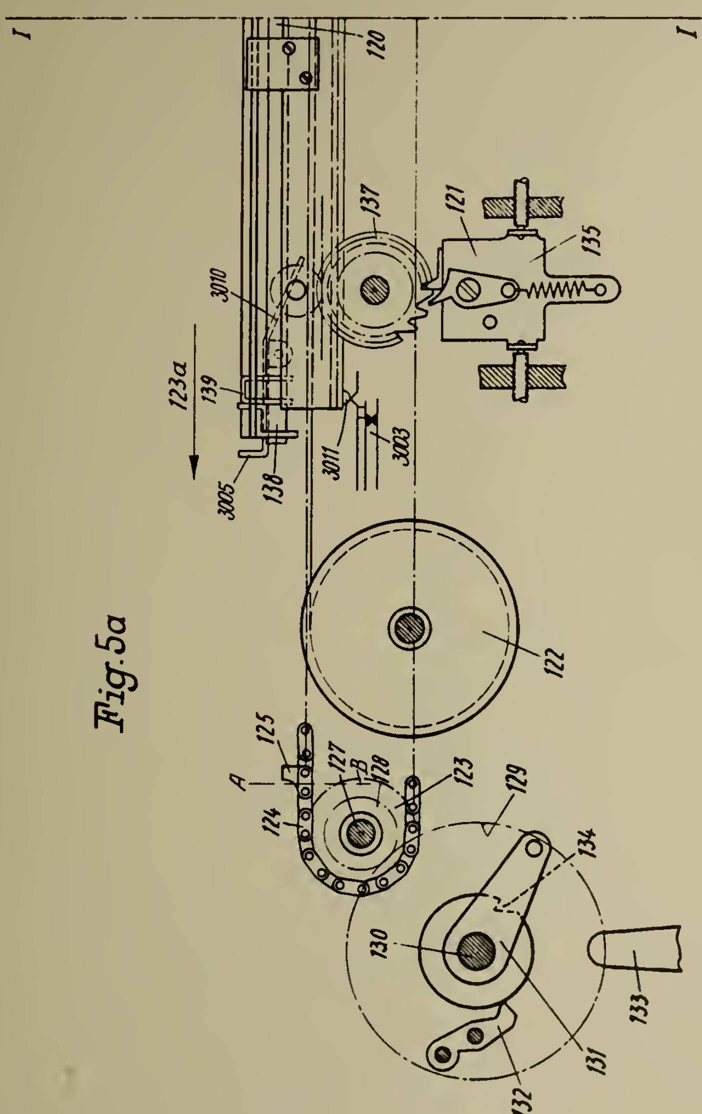

Fig. 5a

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Fig. 5b

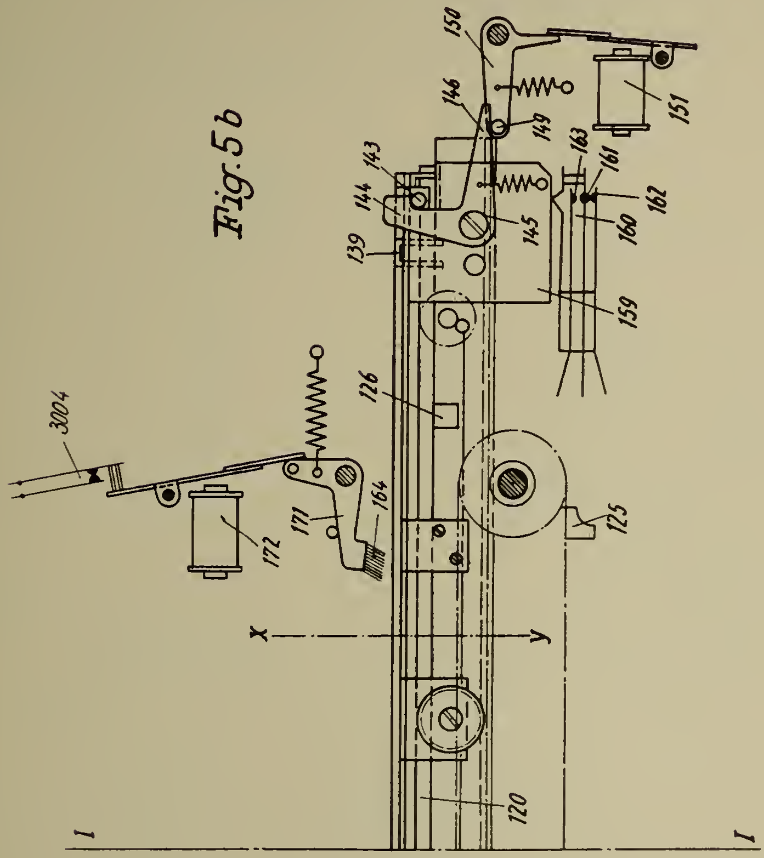

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Fig. 6.

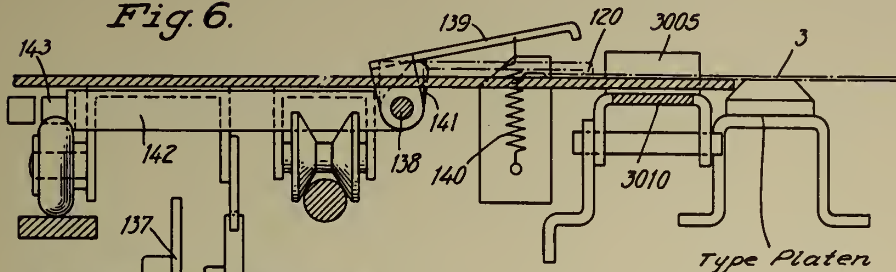
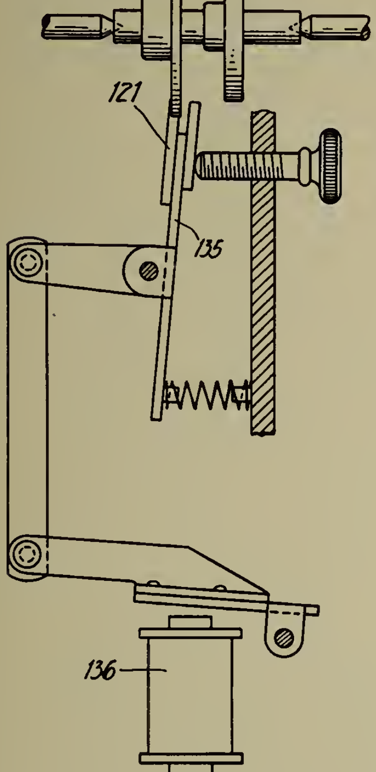



Fig. 8.

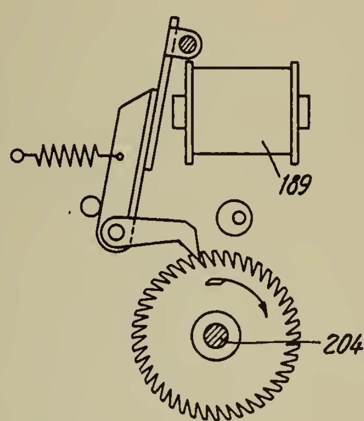
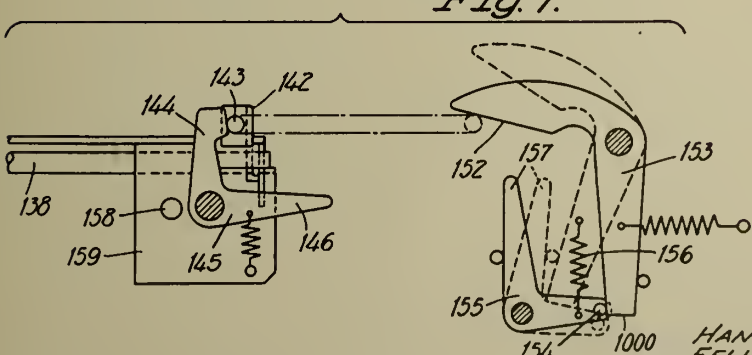


Fig. 7.



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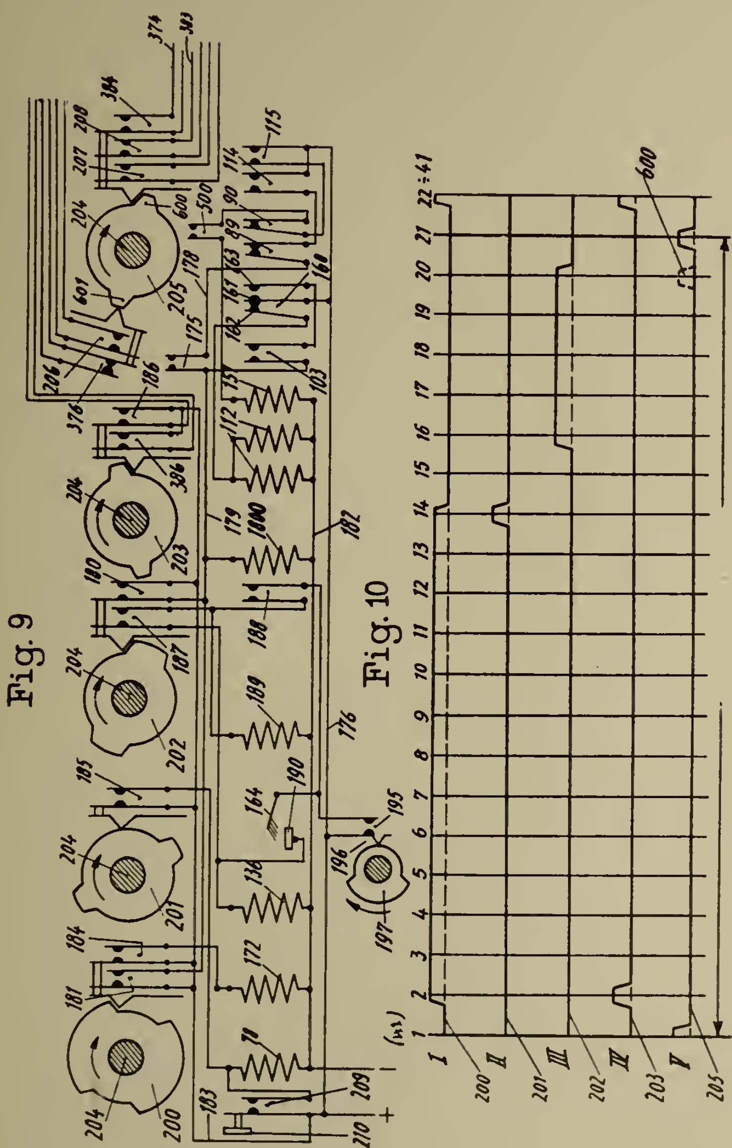

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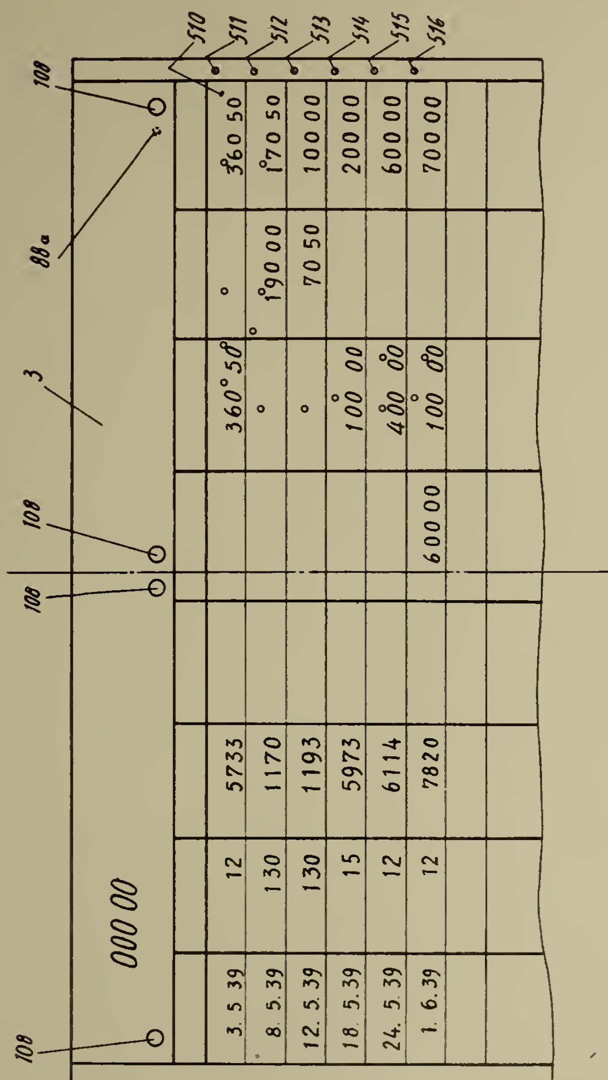

Fig. 11

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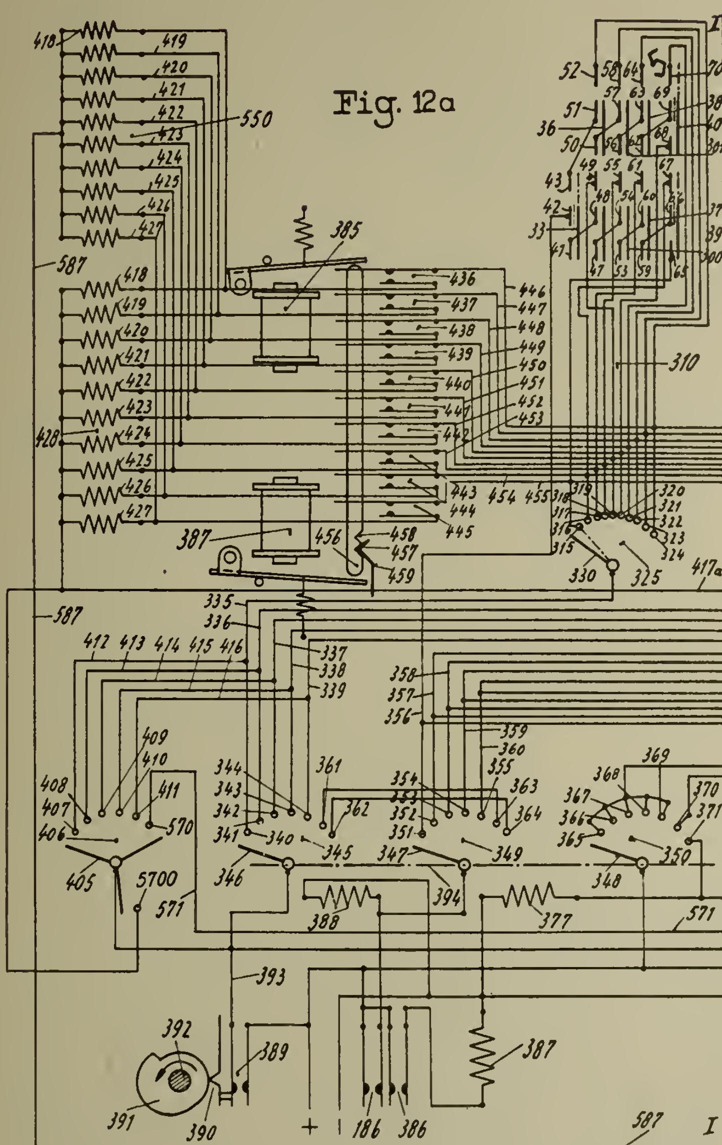

Fig. 12a

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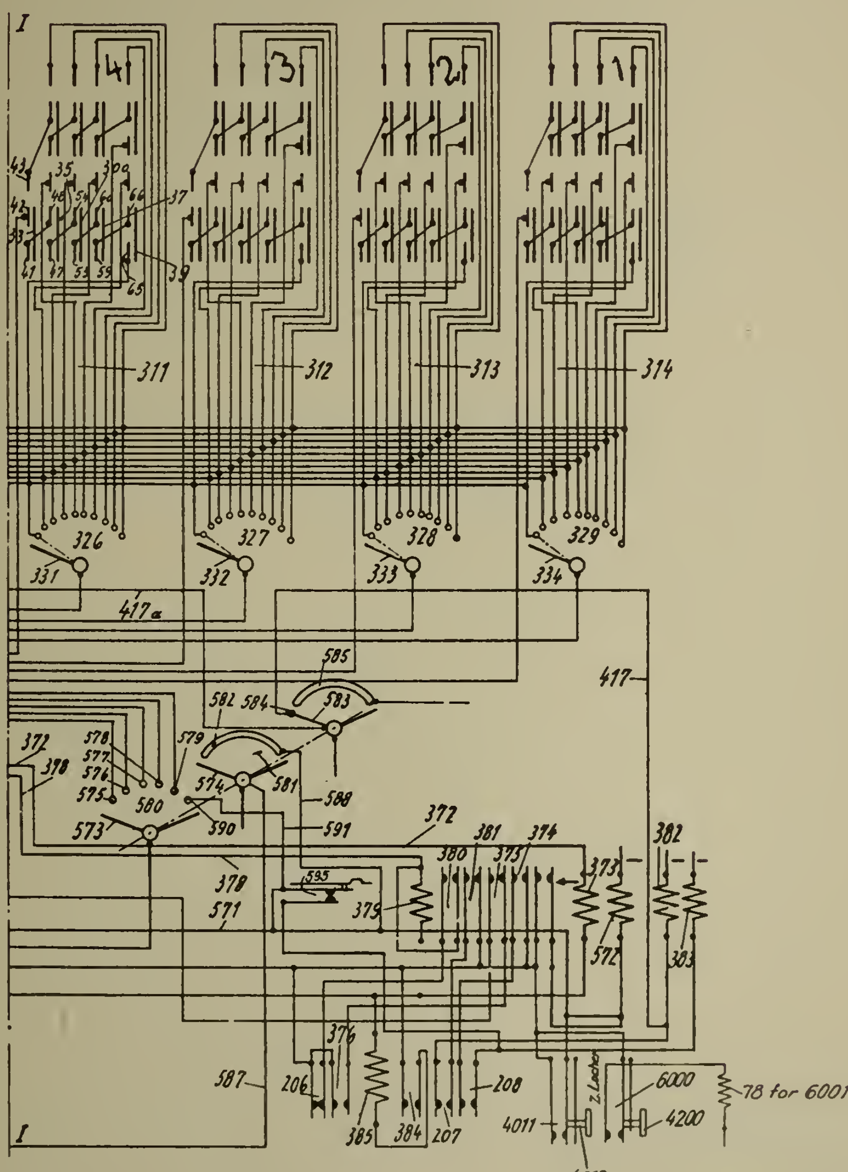
Fig. 12b



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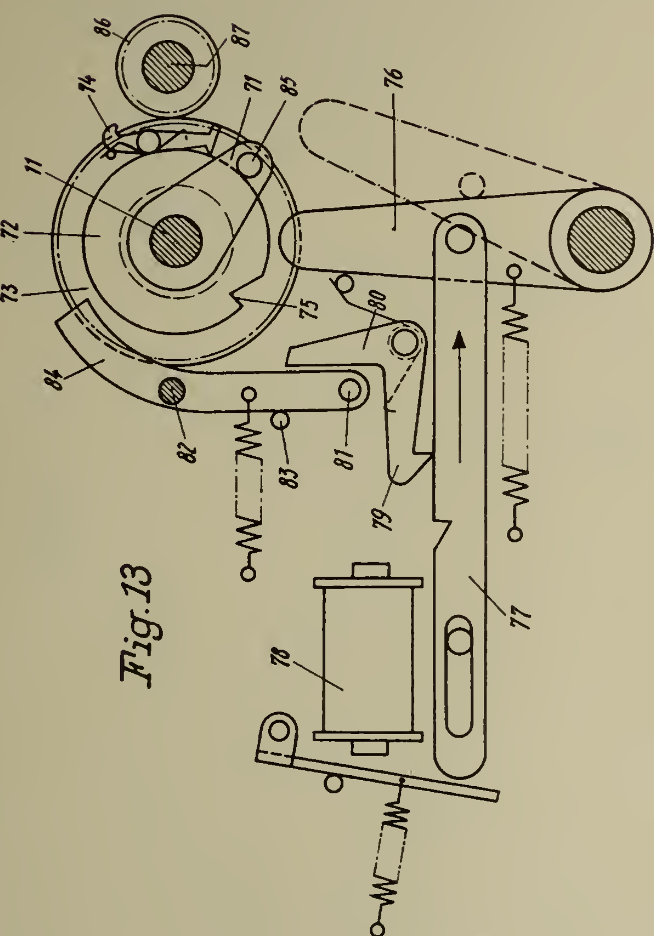

Fig.13

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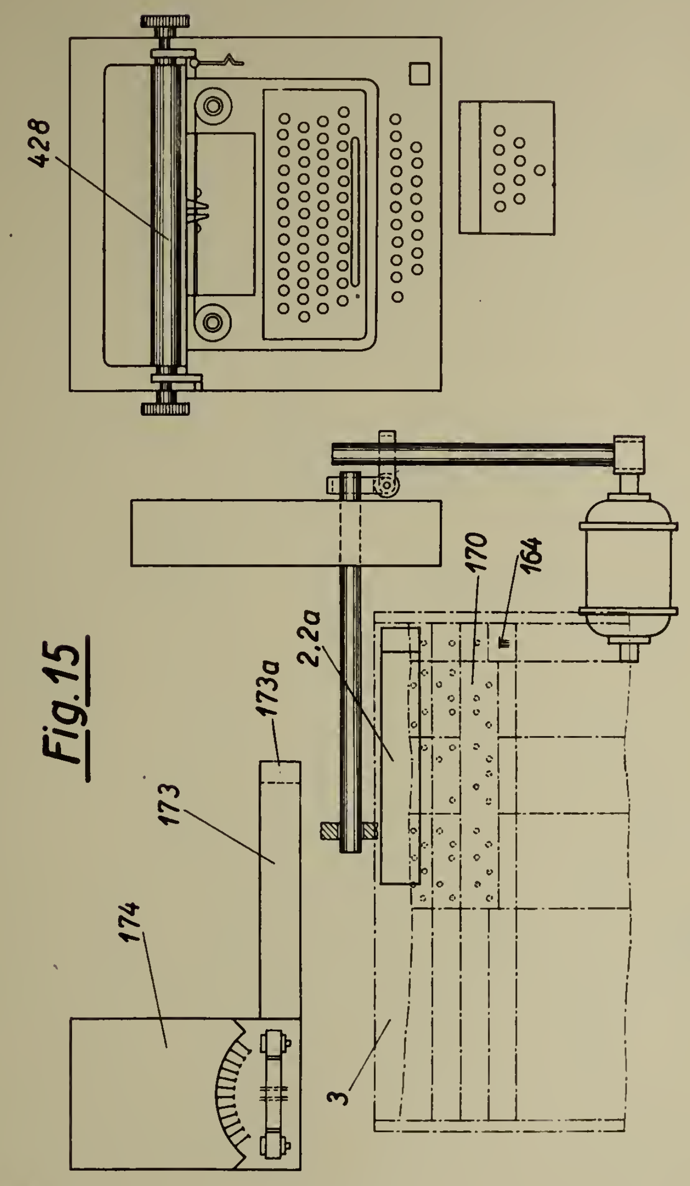

Fig.15

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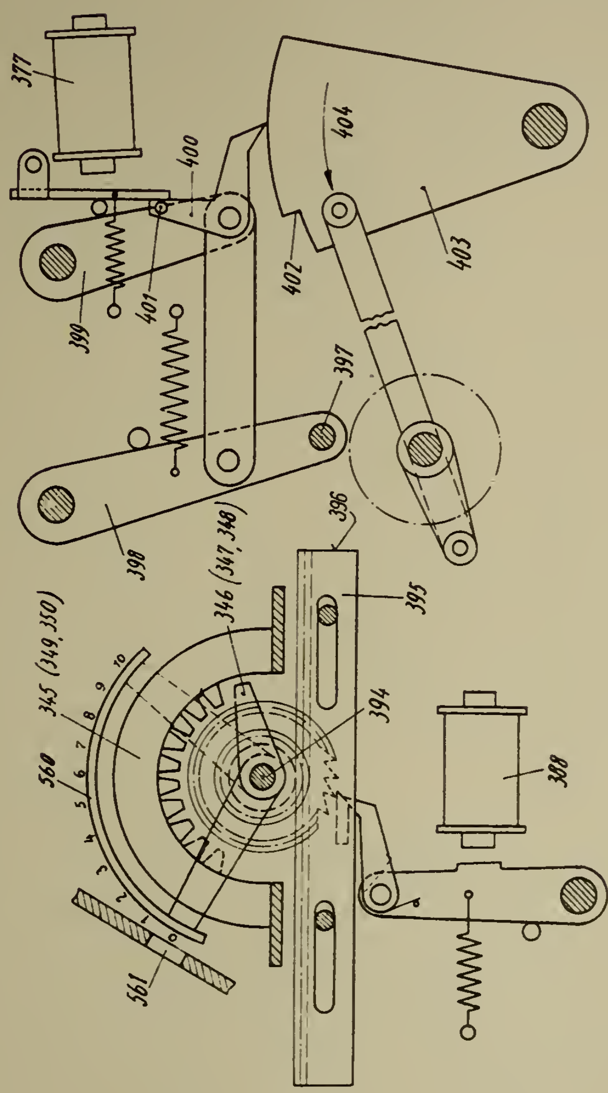

Fig.16

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Fig.17

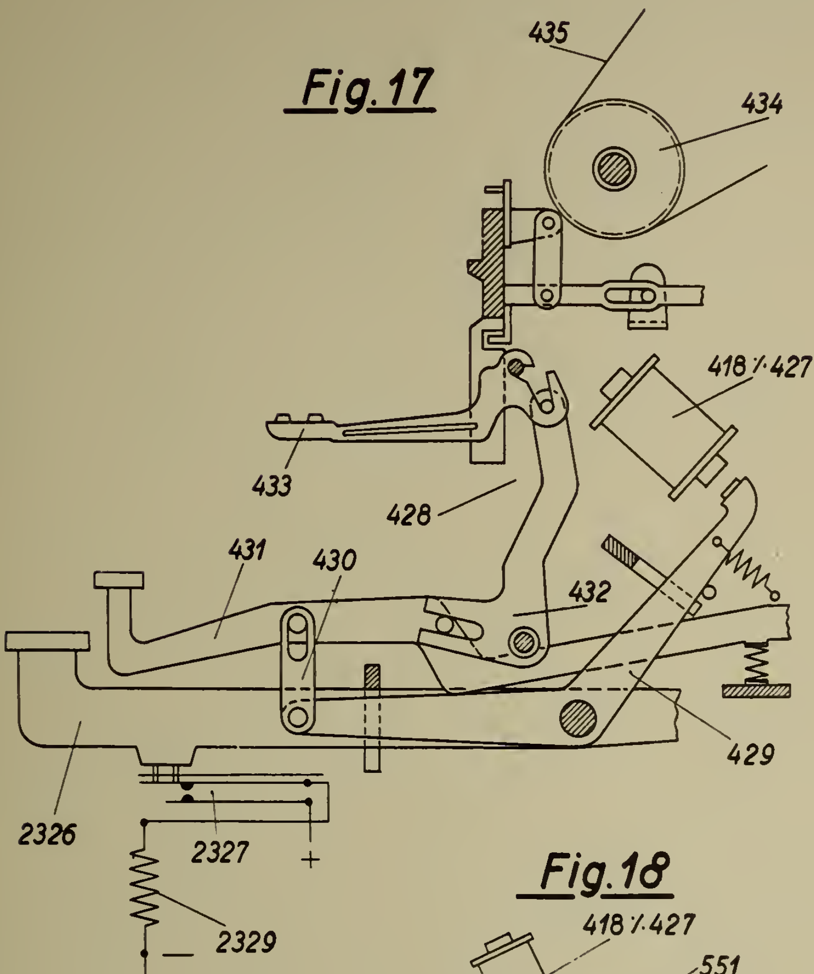

Fig.18

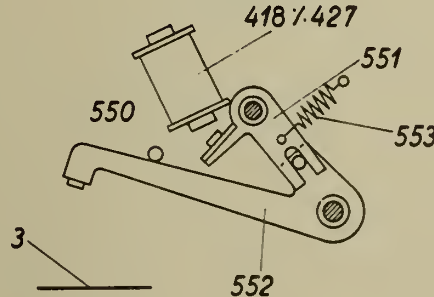

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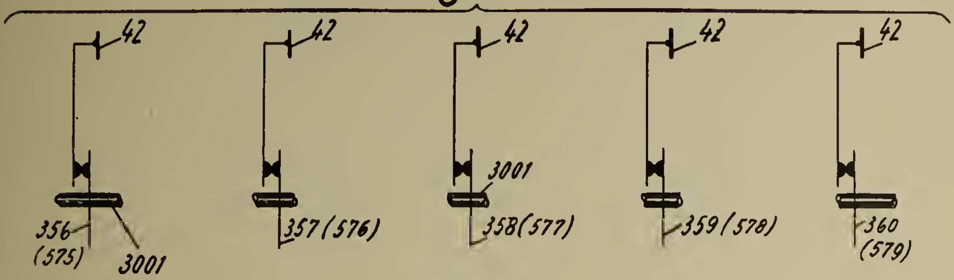
Fig. 19



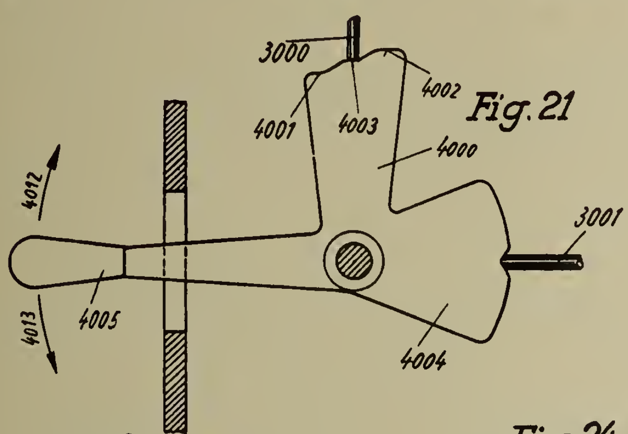


Fig. 21

Fig. 22

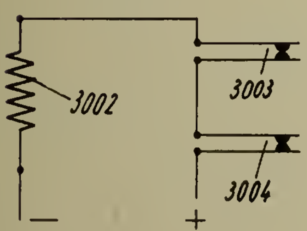
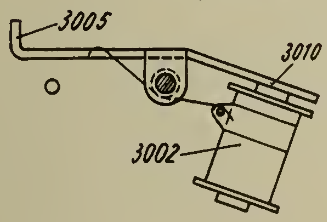


Fig. 24



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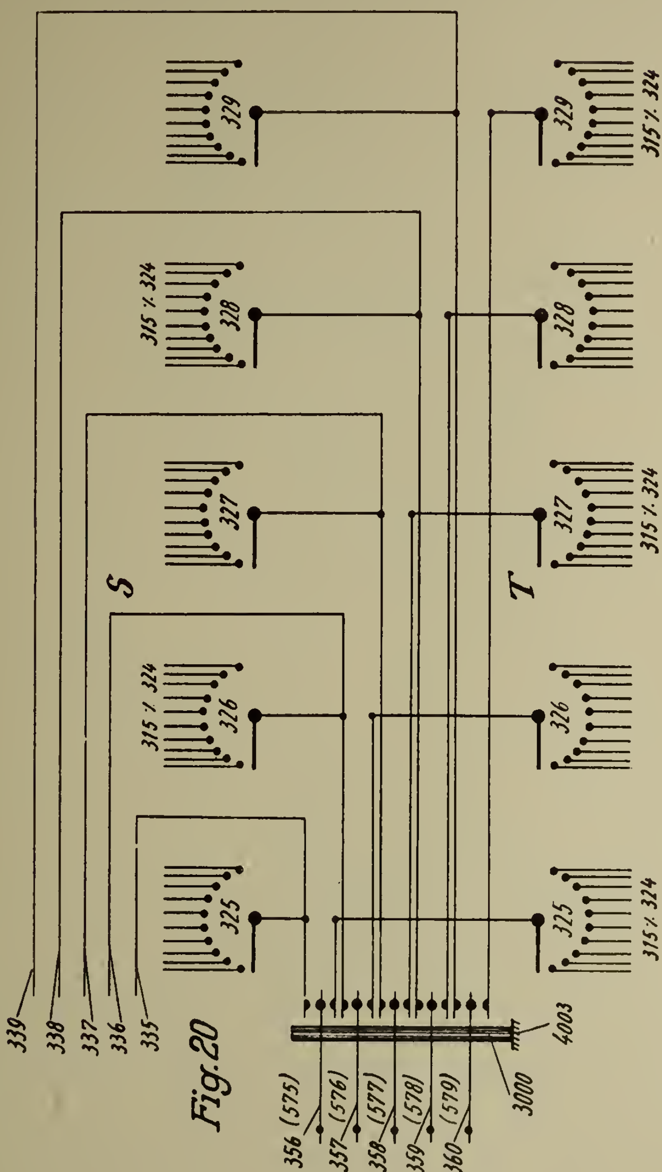

Fig. 20

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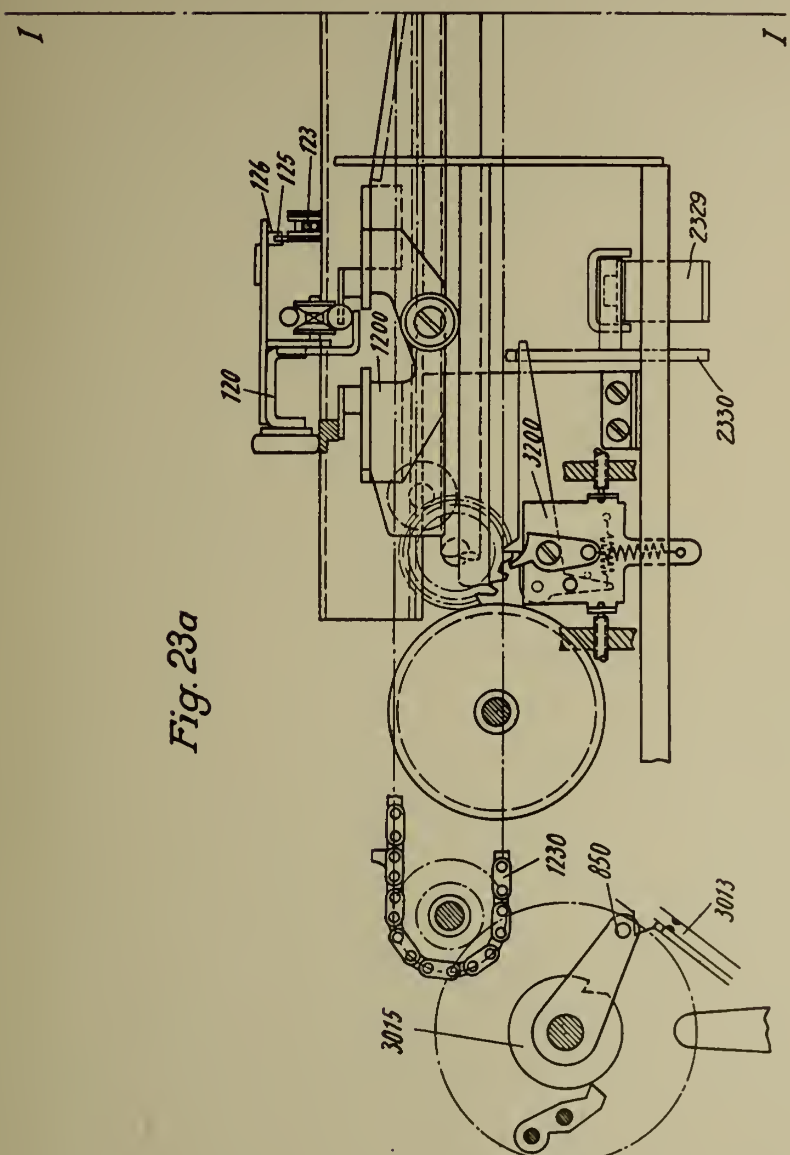

Fig. 23a

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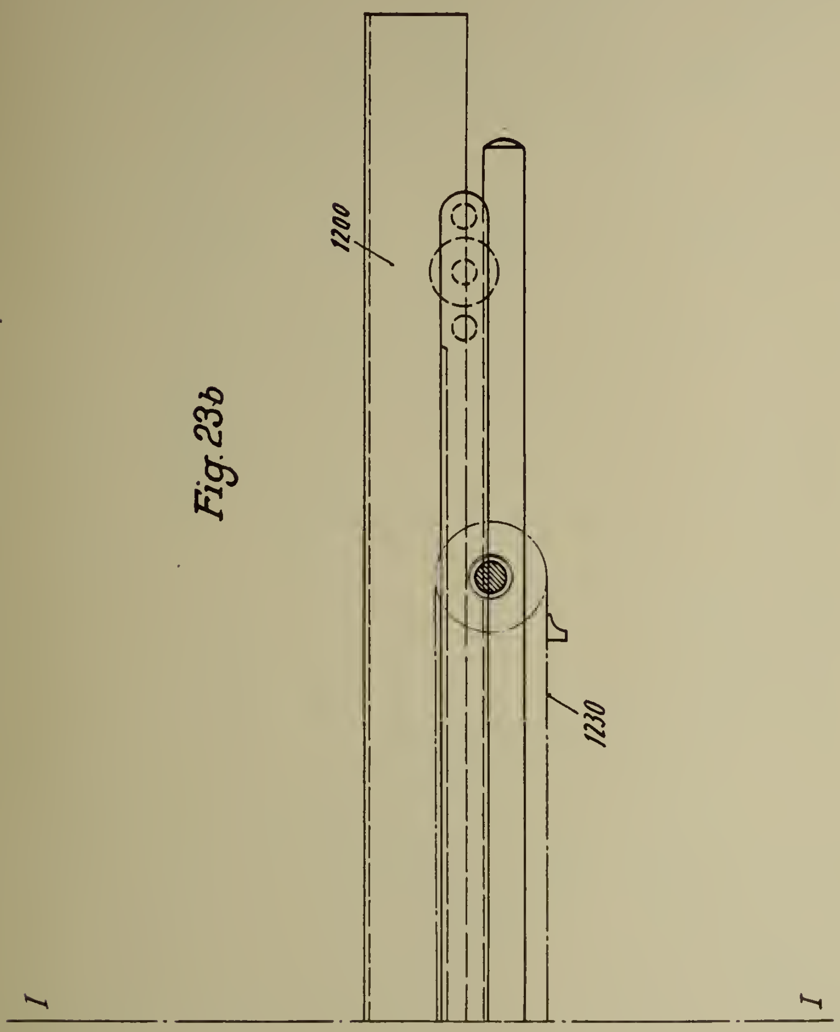

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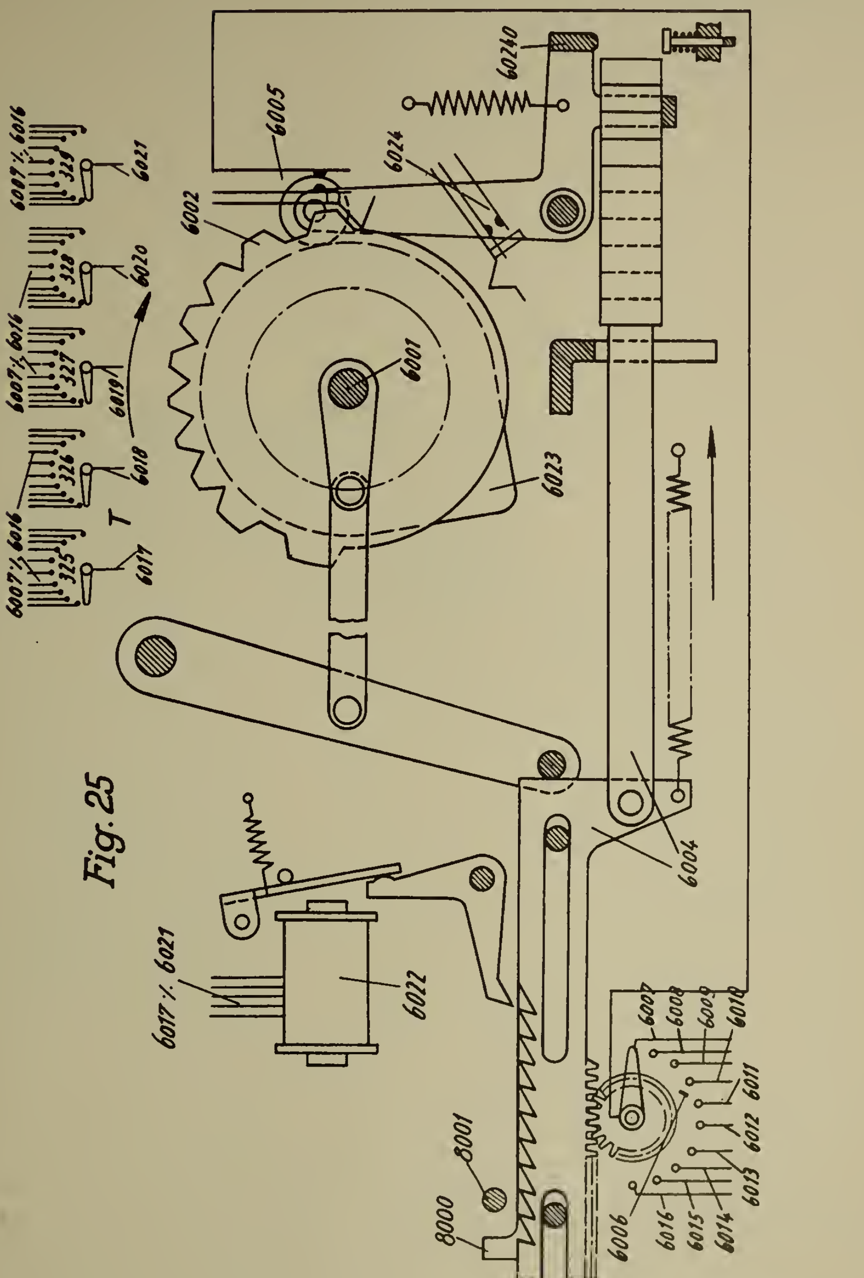

Fig. 25

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BOOKKEEPING MACHINES OR THE LIKE
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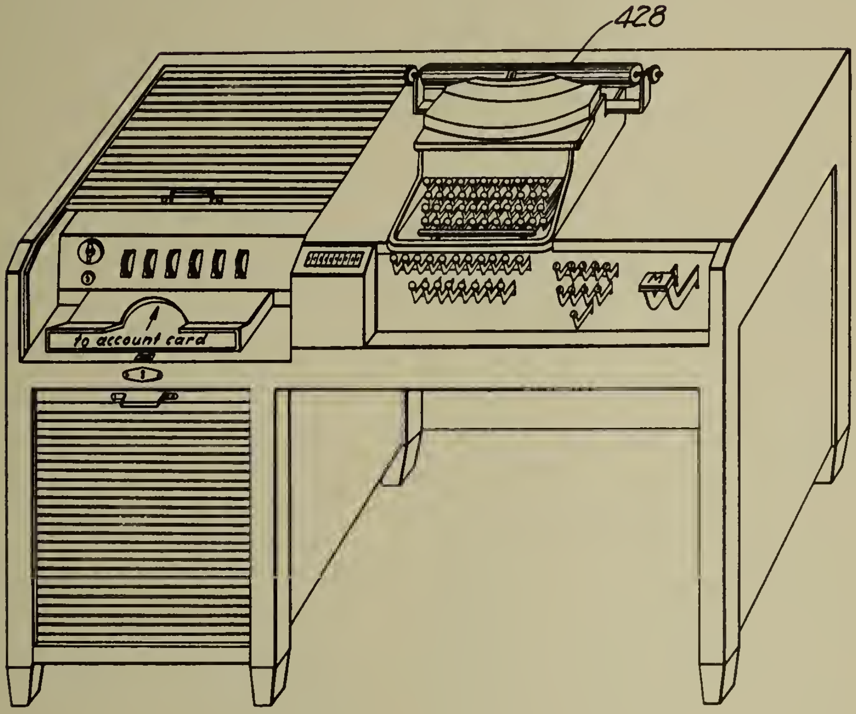
Fig. 26



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Published June 1, 1943 Serial No. 352,972

ALIEN PROPERTY CUSTODIAN

MULTIPLE COUNTER CALCULATING AND REGISTERING MACHINE

Hugo Cordt, Berlin-Schoneberg, Germany; vested in the Alien Property Custodian

Application filed August 16, 1940

The invention relates to a multiple counter calculating and registering machine with booking mechanism and a paper carriage provided with a step rail for controlling the several counting mechanisms performing the bookings or entries and it is an object of the invention not only to perform several bookings in a simple and easy manner with the same machine but also to enter in each booking frequently occurring factors as for instance in connection with current invoices the cost of current or in connection with gas invoices the cost of gas etc. by means of a single adjustment instead of the repeated registration of the factors consisting for the most part of several figures.

A further object of the invention is the provision of a selecting device arranged in the said multiple counter calculating and registering machine in order to rapidly pass over from one kind of booking to an other one by setting a corresponding step rail and to insert or call thereby the corresponding distinct factor. This selecting device may comprise a selector disc similar that which is used in telephone apparatus.

The device known up to the present permit either in performing successive cross-bookings in which the carriage is shifted from right to left from one column to the next one corresponding to the carriage-jumps determined by stops or the like a predetermined fixed order or sequence in bringing into register automatically and successively distinct counting mechanisms and columns or to call optionally counting mechanisms adapted to be selected at liberty in the several positions of the carriage.

The device according to the present invention permits the positive running off of a greater number of different cross-bookings by arranging a corresponding number of different step rails, while the selection of the booking or entry to be made is adjusted by a selector disc.

From this selector disc there are simultaneously controlled:

(1) The step rail to be selected for the respective booking,

(2) The selection of the calculating factor used for the momentary booking to be made,

(3) The carriage-jump for the columns to be leaved out according to the circumstances,

(4) Further, according to the present invention it is also possible to perform a transfer of the drive of the revolution counter mechanism from one column to another one by the adjustment of the selector disc, if desired.

The selecting device according to the present invention is particularly useful for so-called tariff clearing-machines i. e. calculating or booking machines by means of which the bookings or entries of electric power stations, gas-works or waterworks are produced.

In view of the fact that the several accounts and columns store up their amounts in distinct counting mechanisms and furthermore for each column at a determined tariff the same factor is required for the calculation the above indicated four functions or operations may be controlled by the same angular movement of the selector disc.

The selection of the carriage-jump control is also accomplished by the said selector disc as a pawl cooperating with abutment stops is brought out of action on the determined places by the rotation of the selector disc.

Further, it is possible according to the present invention to enter determined and repeatedly occurring factors into the counting mechanisms by the operation of the said selector disc so that it is not necessary to enter these values repeatedly into the key-board.

Further, according to the invention a latching-device permits a selection by means of the selector disc only in a predetermined selector-position so that a selection during the performance of a calculating operation is not possible.

It may be noted that one or the other or several calculating operations adapted to be selected jointly may be dispensed with without departing from the spirit of the present invention.

The invention in its preferred form or approximately such form is illustrated in the accompanying drawings, wherein like characters indicate like parts throughout the several views.

Fig. 1 shows a booking example according to the present invention for illustrating the problem upon which the invention is based.

Figs. 2*a* and 2*b* serving as supplements show the device according to the present invention in a side elevation, and

Figs. 3*a* and 3*b* show the said device in a plan view.

Fig. 4 is a front elevation, and

Fig. 5 a plan view of the selector disc and the keyboard.

Fig. 6 is an elevation from the rear side of the machine.

A selector disc 1 fixed on the spindle 2 is adapted to operate, as above explained, four different devices, viz.

1. The step rail selector control mechanism,
2. The factor control device,

3. The carriage-jump control device, and
4. The revolution counter control mechanism.

The operation of these several control mechanisms is the following:

On the frame of the machine there is fixed a bracket **33** in which is slidably mounted a rail **32** carrying a roller **31** which is urged by means of a spring **34** against a cam disc **3** rotatable with the selector disc **1**. If the said selector disc **1** is rotated the roller **31** with its rail **32** is moved to the left (see Fig. 3b) whereby by means of a two-armed lever **36** pivotally connected at one end with the rail **32**, a draw-bar **35** pivotally connected with the other end of the said lever **36** is shifted to the right as viewed in Fig. 2*a* and 3*a*, so that a bell crank lever **37** pivotally mounted on the frame of the machine is oscillated. One arm of this bell crank lever supports a spindle **40** on which a forked arm **41** carrying a roller **42** is fixed so that on oscillation of the said bell crank lever **37** the said spindle with its arm **41** and the roller **42** is raised or moved downwards respectively. Cooperating with the said roller **42** is a plurality of rails 43_1, 43_2, 43_3 etc. for the tariffs arranged one above the other and the roller **42** may be brought in engagement with each of these rails when lifted by oscillating the lever **37**. This, however, is only possible in the selector position (step n_0, Fig. 3*a*) as in the other positions the selector disc is locked by a latching device later to be described. The accumulator drum drive is also derived from the said roller **42**. An arm **45** oscillatorily mounted at **44** carries a stud **46** on which the said roller **42** is rotatably and axially shiftable mounted, and further a second depending stud **47** with which a stud **49** engages fixed on the accumulator drum control lever **48**. If the roller **42** runs e. g. from the step n_0 to the step n_2 the arm **45** is oscillated and therefore the accumulator drum control lever **48** is lengthwise shifted to the left as viewed in Fig. 2*a* and the accumulator drum (not shown) is operated.

In order to avoid a rotation of the selector disc **1** during a booking or printing operation there is provided a device permitting only in a predetermined position a selecting operation or an operation of the selector disc.

On the paper carriage of which a part is shown at **26** in Fig. 2*a* and 3*a* there is fixed a control rail **62** provided with three steps, for instance, a step 62_1 for the locking position, a step 62_2 for the selecting position and a step 62_3 for clearing the selector disc. Upon these steps 62_1, 62_2 and 62_3 rides a roller **63** rotatably mounted on a lever **65** adapted to be oscillated by the action of a torsional spring **64**. A link **66** is connected with one end to the said lever **62** and with its other end to an arm **68** pivotally mounted at **67** on the frame of the machine, as shown in Fig. 3*b*. Upon this arm **68** is fixed a spring pressed pawl **69** adapted to engage with a ratchet wheel **70** fixedly secured on the spindle **2**. Further a stud **71** is fixed on the said arm **68** and adapted to enter in one of the slots **72** arranged in a locking disc **73** also fixed on the said spindle **2**. If the roller **63** bears upon the step 62_1 of the rail **62** the arm **68** is moved by the link **66** into such a position that the stud **71** enters in one of the slots **72** of the locking disc **73** so that a turning movement of the selector disc is prevented. If the roller **63** is in engagement with the step 62_2 of the rail **62** as shown in Fig. 3*a*, the arm **68** is moved by the link **66** into such a position that the stud is out of engagement with the locking disc **73**, however, the pawl **69** is in engagement with the ratchet wheel **70**. Therefore, the selector disc **1** can now be rotated in one direction and in the example shown in a clockwise direction (selecting position). In the third position in which the roller **63** rests on the step 62_3, the arm **68** is moved by the link **66** so much to the right that the selector disc may be returned in its starting position as also the pawl **69** is brought out of engagement with the ratchet wheel. A toothed bar **51** being under the tension of a spring (not shown) moves the selector disc into this starting position.

In this position an arm **74** fixed on the link **66** presses upon a bell crank lever **5** whereby a roller **6** is lifted off from the cam disc **3** and lies out of the path of the extensions **4** so that the latter do not interfere on the turning back of the selector disc.

Control for the factors

In order to use a constant value repeatedly without the necessity of inserting it afresh by depressing the corresponding key there is provided a factor control device operated from the selector disc. On the spindle **2** there is fixed a toothed gear **50** as shown in Fig. 4 which meshes with a rack **51**. This rack **51** meshes with a plurality of toothed gears **52** of which each is arranged in the corresponding column. Each toothed gear **52** is fixed on carrier **53** provided with a number of adjustable abutments **54**. If the said carrier **54** is depressed by the yoke **55** later to be described, an abutment **54** set corresponding to the rotation of the selector disc **1** is adapted to operate a key bar **56** which is usually depressed by the keys of the multiplying machine. The yoke **55** is shifted by means of two two-armed levers **57** arranged on oppositte sides and adapted to be oscillated by pulling a hand lever fixed on a shaft **51**. On this shaft there are fixed two arms **59** each arranged adjacent to a two-armed lever **57** and each carries a roller **60** adapted to cooperate with the corresponding two-armed lever **57**.

The hand lever **58** may be brought into its original or idle position after a booking operation or entry by means of a device (not shown) by the return movement of the machine in order to use again the columns for new booking operations because the factor entered into the columns are cleared by the return movement of the hand lever **58**.

Carriage shift control

A pin **16** fixed on the upper side of the cam disc **3** is adapted on the rotation of the selector disc **1** to strike against a nose **17** of a lever **19** pivotally mounted at **18** as shown in Fig. 3*b*. On the free end of this lever there is attached a link **20** which is shifted by the actuation of the said lever **19** towards the right. The other end of the said link **20** is connected to a two-armed lever **21** which is moved by this in a counterclockwise direction as viewed in Fig. 2*a*. A spring-pressed lever **22** consisting of two parts and also connected to the said two-armed lever **21** carries at its free end a sliding block **23** which is shifted to the left during the swinging movement of the lever **21**, so that the said sliding block **23** is moved from the path of the switch-member **24** fixed on the paper carriage **26** into the path of the switch-member **25** also fixed on the paper carriage. Now, if the paper carriage is moved to the right as viewed in Fig. 6 the slid-

ing-block **23** is raised and thereby oscilated a two-armed lever **21** also connected to the said lever **22**. A link **28** connected to the lever **21** at one end and to a pivotally mounted pawl **29** at its other end transmits this movement to the said pawl so that a locking engagement of the said pawl **29** with the corresponding abutment-stop **30** of the paper carriage does not occur. The abutment-stops **30** are adjustably secured on a bar or rail secured to the paper-carriage. A locking engagement of the pawl **29** with an another abutment-stop takes place as soon as the sliding block **23** is slid over the switch-member **24** or the switch-member **25** respectively.

Revolution counter control

On the lower end of the spindle **2** there is fixed a cam **3** provided on its under side with a plurality of projections **4** adapted to cooperate with a roller **6** fixed on a bell crank lever **5**. A link **8** pivotally connected to the said lever **5** at one end is attached with its other end on a spring pressed arm **9** fixed upon a shaft **10**, so that by the tension of the said spring **7** the roller **6** is urged against the projections **4**. If on the other hand during the rotation of the selector disc **1** a projection **4** impinges upon the roller **6**, the bell crank lever **5** is oscillated and, therefore, by means of the link **8** and the arm **9** the shaft **10** is rotated. Upon this shaft **10** there are fixed two levers **11**, **11***a* arranged in staggered relation to one another and each provided with a stud **12**, **12***a* adapted to operate the levers **13**, **13***a* provided with cam faces with which the said studs cooperate. While on the oscillation of the shaft **10** the lever **11***a* with its stud **12***a* is brought out of the field of action of the lever **13***a* the lever **13** is swung out by the lever **11**. The ineffective lever **13***a* is moved by its spring **75** against an abutment-stop. The ends **15**, **15***a* of these levers **13**, **13***a* are in engagement with the catch or indexing fingers **76** of the revolution counter mechanism **77** and have the effect to transfer the drive of the said revolution counter from one column to the other during the rotation of the selector disc.

The simultaneous operation of the above described four functions performed in the example shown by a selector disc can also be made by other setting means which in their effect are similar to the working of such a selector disc.

While I have set forth the idea of my invention in the foregoing, it is obvious that many changes and variations might be made without departing from the spirit of the invention and I desire to have it understood that the specific terms herein are used in their descriptive and not in their limiting sense.

HUGO CORDT.

PUBLISHED

JUNE 1, 1943.

BY A. P. C.

H. CORDT
MULTIPLE COUNTER CALCULATING AND
REGISTERING MACHINE
Filed Aug. 16, 1940

Serial No.
352,972

4 Sheets-Sheet 1

Fig. 1

Soll-Liste

Monat:

Zählerstand		Verbrauch		Einzelpreis	Betrag		Grundgebühr Licht = L Kraft = K Gas = G Wasser = W		Müllgebühr = M Kanalisation = Ka		Ratenzahlung		Gesamtbetrag			Nummer des Abnehmers
vorletzter	letzter	cbm bzw. kWh		Rpf.	RM.	Rpf.	RM.	Rpf.	RM.	Rpf.	RM.	Rpf.	RM.	Rpf.		
170	209		3.9 L	40 L	15	60 L	1	25 L								
210	235		25 K	25 K	6	25 K		75 K								
1465	1513	48	K	8 K	3	84 K										
1699	1852		153 G	17 G	26	01 G		60 G	1	50 M						
352	419		67 W	22 W	14	74 W	1	15 W			3	30	74	99	=	4401
3134	3192		58 L	40 L	23	20 L	1	25 L								
405	465	60	L	12 L	7	20 L										
8	100		92 K	19 K	17	48 K		75 K								
5756	5819	63	G	10 G	6	30 G		60 G	1	50 M						
2476	2533		57 W	22 W	12	54 W	1	15 W	2	20 Ka			74	17	=	4402
134	216	82	L	19 L	15	58 L	1	25 L								
5739	5899		110 L	8 L	8	80 L										
34	165	131	K	12 K	15	72 K		75 K								
714	955	241	W	19 W	45	79 W	1	15 W	2	20 Ka	5	75	96	99	=	4405
4621	4679	50	L	19 L												
		75	L	12 L												
			33 L	8 L	21	14 L	1	25 L								
1451	1588		137 K	25 K	34	25 K		75 K	1	50 M						
345	488		143 W	22 W	31	46 W	1	15 W	2	20 Ka	5	50	99	20	=	4406
				zu												
kWh zu 19	Rpf	132	97 L	≑ 40	91	52 L	≑5	00 L	≑4	50 M	≑14	55 =	345	35	≑	
kWh " 12	"	135	143 L	≑ 8												
kWh " 8	"	48	162 K	≑ 25	77	54 K	≑3	00 K	≑6	60 Ka	≑					
kWh " 12	"	131	92 K	≑ 19												
cbm " 10	"	63	153 G	≑ 17	32	31 G	≑1	20 G	≑							
cbm " 19	"	241	267 W	≑ 22	104	53 W	≑4	60 W	≑							

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Fig. 2a

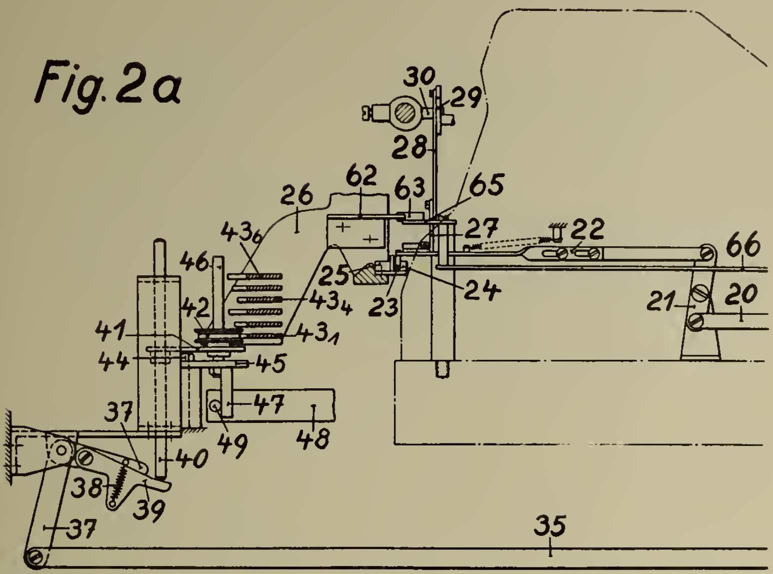

Fig. 3a

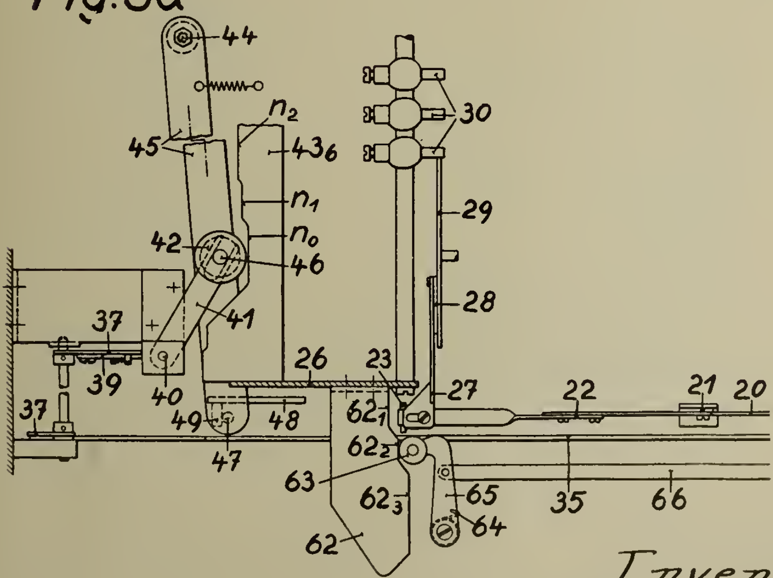

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Fig. 2b

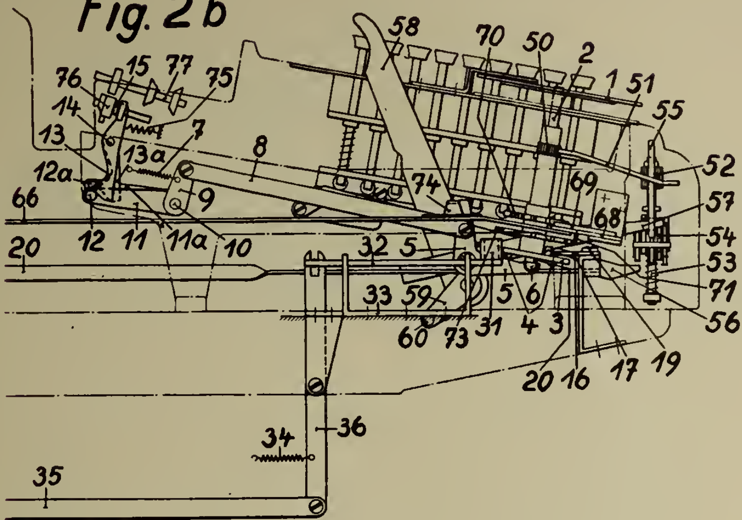
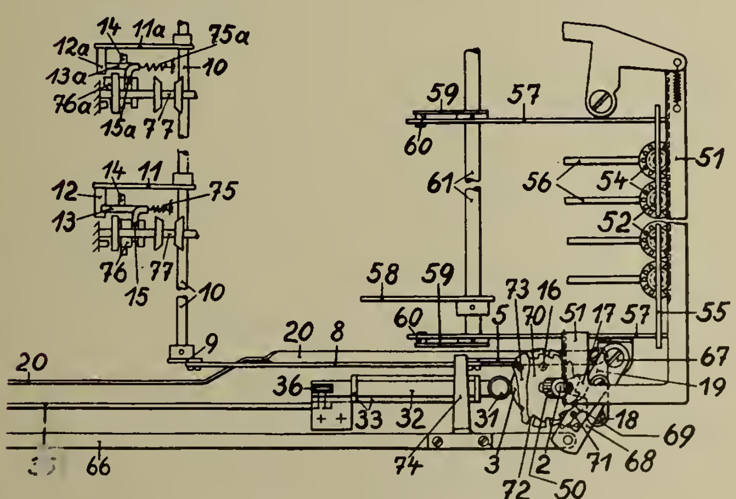


Fig. 3b



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4 Sheets-Sheet 4

Fig. 4

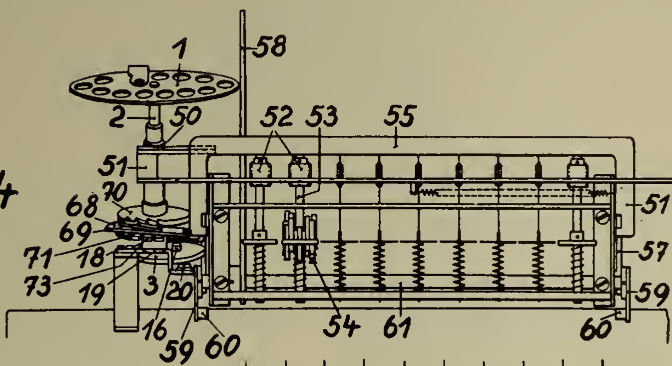


Fig. 5

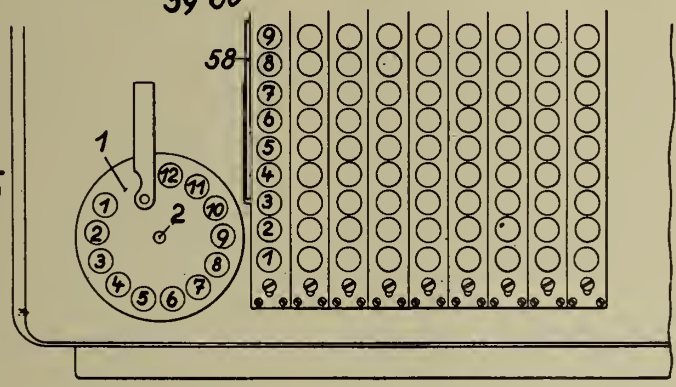
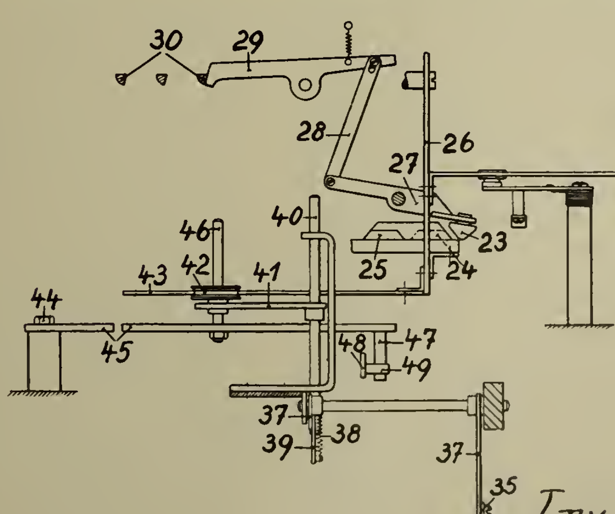


Fig. 6



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ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF LOW-CARBON FERRO-ALLOYS

René Perrin, Paris, France; vested in the Alien Property Custodian

Application filed September 7, 1940

It is known that the manufacture of low carbon ferro-alloys generally comprises two distinct principal steps. In the first step, an alloy rich in silicon, e. g. ferro-silicon, is manufactured, e. g. by reducing by means of carbon in an electric furnace, a suitable mixture of silica and of ore of the alloying element, an addition of lime being usually made in order to fluidify the slag which is formed during the process. The alloy obtained in this first step has a low carbon content. In the second step, the silicon-alloy which has been obtained during the first step, is treated by means of a slag which is rich in the oxide of the alloying element, in view of eliminating the silicon and finally obtaining a ferro-alloy which is at the same time poor in carbon and in silicon. The iron present in the said alloy is originated either from the ore which is heated in the electric furnace or from the oxide of the alloying element which may be mixed with an oxidic compound of iron, or again from both ore and oxide, or also from ferrous metal, e. g. mild steel scraps, added in the furnace.

In the previous processes, the second step of the operation was often carried on in a furnace and several slagging off operations were necessary, or an important amount of oxide of the alloying element was systematically left in the final slag. In all these processes the said operating steps led to bad yields in alloying element owing to the insufficient exhaustion of the slag as concerned the oxide of the said alloying element.

The process hereabove recalled has been largely used for the manufacture of ferro-chromium, the iron being contained both in chromium ore which is treated in the electric furnace, and in chromium oxide which was made a constituting part of the desiliconizing slag. Ilmenite was practically the material to which it was resorted in that case, as being the ore of the alloying element and also the oxide forming the basis of the desiliconizing slag. Both the chromium and the iron oxides were reduced by the silicon of the silicon-alloy and thus iron passed into the alloy.

More recently the applicant has proposed, in order to accelerate the second step and to increase the yield thereof, to energetically intermix the molten silicon-alloy and the slag, which rapidly realises a chemical equilibrium between slag and silicon-alloy. However, when in such a process an attempt has been made to lower to very small figures the silicon in the final alloy, it has proved that important quantities of oxide of the alloying element were necessarily left in the slag. Although such quantities are much smaller than those resulting from a treatment which does not comprise an energetic intermixture of silico-alloy and desiliconizing slag, it is obvious that it would be much more advantageous to keep them down. As a matter of fact, when the said process is used for the manufacture of a ferro-chromium having a low content of silicon, it is necessary to leave in the final slag a chromium oxide (Cr_2O_3) content comprised between 4 and 8%. Accordingly, it is generally resorted in the processes hereabove recalled to a practice in which the desiliconizing slag which has been insufficiently exhausted as concerns the oxides, is charged anew in the furnace in which the silicon-alloy has been manufactured and where it is subjected again to a reducing operation. But this method of carrying out the process led to an increase in the net cost of the manufacture of the silicon-alloy.

The present invention refers to a process for the manufacture of low carbon ferro-alloys.

One object of the invention is to ensure a very economical run of the silicon-alloy furnace.

Another object of the invention is the obtention of a ferro-alloy which has a very low final content of silicon in the ferro-alloy, at a low cost and in a short time.

Another further object of the invention is to nearly totally exhaust the slag used for the desiliconizing, as concerns the metallic oxides contained therein.

Other further objects of the invention result of the disclosure set forth in the following part of the present specification and in the appended claims.

The process according to the invention consists in manufacturing a low carbon alloy which contains a high proportion of reducing agent, for instance silicon, by reducing by means of carbon preferably according to an acid run of the alloy-furnace, a mixture of an oxidic compound of the reducing element e. g. of quartz, and of an oxidic compound of the metal to be alloyed, for instance an oxide thereof, and then by successive operations, the content of silicon of the alloy thus obtained, by means of a slag which has as a basis an oxidic compound of the alloying metal and a non volatile base such as lime, namely: an operation comprising an energetic intermixing between the said alloy in molten state, and slag resulting from the second operation carried on on a preceding melt, intermixing by which the said slag is practically exhausted as concerns the oxidic compound of the alloying metal, and

by which the alloy rich in reducing agent is partially oxidized as concerns the said reducing element, and another operation comprising a treatment of the said partially oxidized alloy, by means of a fresh slag having as a basis an oxidic compound reducible by the reducing agent of the alloy, e. g. an oxide or ore of the metal to be alloyed and a non volatile base, such as lime, treatment by which the reducing agent of the alloy is oxidized down to the final content which is wanted as concerns the reducing agent.

The process according to the invention thus essentially comprises three stems, namely, first step, manufacture of a primary alloy rich in reducing agent and poor in carbon; second step, an oxidizing operation of the said alloy to transform it in an intermediate alloy having a medium content of reducing agent, and to give rise to an exhausted slag; third step, a second final oxidizing operation to transform the intermediate alloy into final low-reducing-agent alloy, and to give rise to an intermediate slag having a medium content of oxidizing substance which is used for treating a fresh batch of primary alloy as above set forth. This process ensures, owing to the combination of these three steps, the obtention of low carbon and even very low carbon ferro-alloys having a very low content of reducing agent with a total yield which is extremely high as concerns the alloying metal and at a net cost decidedly lower than the previously known processes.

The process according to the invention can be applied to the manufacture of any low carbon ferro-alloy: ferro-chromium, ferro-manganese, ferro-titanium, ferro-molybdenum etc. The reducing agent which is preferably used is silicon. However, in the following description and for the sake of simplification, it will be more specially referred to the manufacture of ferro-chromium, silicon being used as reducing agent, but it should be understood that the explanations given in the said disclosure apply as well, with the necessary modifications, to the manufacture of any other ferro-alloys coming in the range of the present manufacturing process and to any other chemically equivalent reducing agent.

In the manufacture of a ferro-chromium according to the process of the invention, the first step, consisting in the manufacturing of silico-chromium in a furnace, is notably characterised in that it practically necessitates but the handling of fresh materials, namely, chromium ore and silica—preferably quartz—without any use of used slags or any necessary addition of fluidifiers. The subsequent desiliconizing operations do not in fact finally give rise to any residue which is rich in chromium oxide which necessitates a further treatment in the silico-chromium furnace, because the slag which is used for these desiliconizing operations is finally practically exhausted as concerns the oxides, especially the oxide of the alloying metal. In the previous processes where the residual slag resulting of the desiliconizing operation were subjected to a further reducing operation in the silico-chromium furnace, the important proportion of lime contained in the slag led to an extra expense of thermal energy for melting again the slag and compelled to carry on a reduction operation at a relatively high temperature, owing to the enrichment in lime of the materials to be fused and to the lowering of the percentage of the content of free silica. Experience has shown that the reduction of the mixture of chromium ore and quartz takes place in very favourable conditions when the run of the furnace has an acid character, according to the invention. The operation can further be carried on at a less elevated temperature for a same content of silicon in the silico-alloy, than with slags which are rich in lime, and without it being necessary to add fluidifiers. As a mere indication the constumption of electric current when manufacturing low carbon silico-chromium having a very low content of silicon according to the invention, is lowered by 20 to 30% when compared with the previous processes, which constitutes a considerable saving of money and increases the daily output of the furnace.

Moreover, the acid running of the silico-chromium furnace has the advantage that for an equal content of silicon, the silico-chromium obtained has a carbon content lower than the one which is obtained in the previous processes This allows accordingly, either to manufacture silico-chromium and consequently ferro-chromium having a lower content of carbon, or the content of carbon being finally the same as before, to start from silico-chromium having a lower content of silicon, which constitutes a further saving of money owing to the amount of quartz to be used and to be fused being curtailed.

It should be however underlined that the acid run hereabove referred to for the manufacture of the silico-chromium is rendered economically possible only because the means which are provided by the invention for the desiliconizing of the silico-chromium lead to a nearly total exhaustion of the residual slag as concerns chromium oxide.

The second step of the process comprises a partial first desiliconizing operation of the silico-chromium which has been manufactured in the first step. This partial desiliconizing is carried on by means of desiliconizing slag resulting of the third step of a precedent melt, and which is already partially exhausted as concerns chromium-oxide but still contains important quantities of the latter. The treatment is advantageously carried on by energetically intermixing the silico-chromium and the slag, both in molten state, according to any of the known processes previously proposed by the inventor for intermixing metal and slag, namely intermixing by a rapid pouring of the molten metal in thick jet from a considerable height onto the molten slag placed in a ladle; or intermixing by means of an apparatus comprising two rocking or rotating receptacles closely opposed to each other by their openings, the content of one receptacle being violently poured in the second one and vice-versa; or again intermixing the metal and slag by repeatedly lifting these two substances and allowing them to simultaneously tumble down by successive rolling operations, in an apparatus formed of two frusto-conical chambers united by their largest sections and rotated about a transverse common axis, the speed of rotation of the apparatus being high enough that some interpenetration of the slag and metal contained therein takes place. Such intermixing leads according to the invention as it has been disclosed hereabove, to a nearly total exhaustion of the slag as concerns Cr_2O_3 and to a desiliconizing of the silico-chromium which is only partial.

At last, in the third step of the process, the silico-chromium, which has been partially desiliconized during the second step hereabove referred to (first desiliconizing operation) is taken again and treated by means of a slag having as

a basis chromium ore and lime. This treatment can be carried on by any convenient means, either by an intermixing of alloy and slag, which is always preferable, or without intermixing. The operation can notably be carried on in one of the apparatus hereabove referred to and by the processes described in connection therewith, or in any other intermixing apparatus, or also by violently pouring the metal onto the slag in a ladle, from a considerable height, or in a furnace by any known process, starting from silico-chromium, either in solid or in molten states, the slag being partially or totally charged in a molten state. The amount of chromium ore which has to be used is calculated in such a way that practically, the quantities of reducible oxides contained in the ore (Cr_2O_3 and FeO) stoichiometrically correspond to the total amount of silicon which has to be eliminated out of the silico-chromium alloy. As a rule, the higher is the proportion of lime, the lower is the final content in the silicon and the higher should be the content of Cr_2O_3 in the third step. The amount of lime to be added also depends upon the composition of the ore. The higher is the proportion of chromium oxide with respect to the iron oxide the greater should be the amount of lime added. The lime may be partially replaced by another basic substance or other substances such for example as magnesia.

During this last step, the desiliconizing of the silico-chromium can be carried on until the figure which is wanted is reached, the final content of silicon which is obtained being the lower the higher are the contents of the slag in basic substances and Cr_2O_3. Owing to the fact that in this third step a relatively high content of the resulting slag can be reached as concerns Cr_2O_3 without inconvenience—the said slag being used again in the second step (first desiliconizing operation) of a next step, and being therein nearly totally exhausted as concerns chromium oxide—it is conceivable that the amount of basic substances and especially of lime, which is to be used will be smaller for the obtention of a given final content of silicon, than in the previously known processes.

Practically, iron is present in the process by the mere fact that the ore of the alloying element contains iron. In the case of the manufacture of ferro-alloys, notably ferro-chromium iron is by nature present in the chromium ore (ilmenite). But iron can in any case be added to the process either in the furnace in which the primary alloy is manufactured or in the furnace in which the primary slag is fused.

On another hand, the primary slag made of oxidic compound or ore of the alloying element and of an oxide of a non volatile basic element may be obtained by fusing ore of the alloying element in the slag furnace and by adding thereto the basic oxide in the intermixing device.

It clearly appears from what is disclosed hereabove that owing to the combination of the two desiliconizing operations (second and third steps of the process) according to the invention, the amount of chromium ore to be used for the desiliconizing does not theoretically supersede the one which stoichiometrically corresponds, as concerns the reducible metallic oxides, to the amount of silicon which is to be eliminated, and that the said ore is totally exhausted as concerns chromium, during the second step of the process (first desiliconizing operation). No residual slag more or less rich in oxides, has thus to be treated anew in the silico-chromium furnace, which allows as it has been disclosed above, to advantageously realize a running of the said furnace having an acid character.

It is to be remarked that if the three steps of the process according to the invention necessarily follow each other according to the sequence which has been indicated when they are considered as applied to the manufacture and the treatment of one and the same melt of silico-chromium, the carrying on of the process can however give rise to modifications as concerns the timely material succession of these three steps, as it is shown in the various embodiments hereabove described, these embodiments being disclosed as examples of practicing the invention.

First embodiment.—An appliance is used which comprises an electric furnace for the manufacture of silico-chromium alloy, a furnace for the fusion of chromium-ore and an intermixing apparatus made of two receptacles, each of them being open at one end, these two ends being closely united together in such a manner that the longitudinal axes of the two chambers make an angle of about 90°, and that there is a common lip for the two chambers over which the content of one chamber can be poured into the other chamber. These two chambers are mounted on a common oscillating axis—practically parallel to the said common lip—and means are provided for rocking the ensemble of the said apparatus and by these means energetically pouring the contents of one receptacle into the other and vice-versa.

The accompanying drawing diagrammatically shows such an appliance in which **1** is the tilting furnace for manufacturing the primary silico-chromium, **2** the tilting electric furnace for fusing the primary slag, **3** the rocking intermixing apparatus open at **4** and comprising two adjacent receptacles **5** and **6** having a common lip **56**, pivoted on a horizontal shaft **7** carried by a double frame **8** and rocked by a motion device **9**. Between the two parts **8** of the said frame is a pit **10** into which ladles **11** and **12** can respectively be sunk in order to cast the final ferro-chromium alloy poor in silicon and to discard the final slag poor in oxides. The primary silico-chromium and the primary slag are run into the intermixing apparatus respectively by means of the removable gutters **13** and **14**.

The third step (second desiliconizing operation) of a preceding intermixing operation in the rocking apparatus **3** being supposed as terminated, the molten slag (intermediate slag) resulting of this step and which still contains substantial proportions of oxides (chromium and iron oxides) is left in the apparatus and a batch of silico-chromium alloy (primary alloy) manufactured in the silico-chromium furnace **1**, is charged into the receptacle of the apparatus **3** in which the intermediate slag has been left. The silico-chromium can be introduced in the apparatus either in molten state or in solid state. The latter occurrence permits of rendering the functioning of the intermixing apparatus **3** timely independent of that of the silico-chromium furnace. After the intermixing of the silico-chromium and slag has been performed in the rocking apparatus and the silico-chromium has been partially desiliconized, the slag is allowed to seprate from the metal and it is discarded, being practically exhausted as concerns oxides. It is then replaced in the rocking apparatus by molten chromium ore taken from the slag fusion

furnace 2 and a new operation of intermixing is carried on by progressively adding lime in solid state in the apparatus 3, thus forming primary slag. When the reaction between the partially desiliconized silico-chromium (intermediate alloy) and the mixture of chromium ore and lime (primary slag) is ended, the ferro-chromium which has been desiliconized to its final content of silicon, is cast and there remains in the intermixing apparatus 3 a molten slag (intermediate slag) which is ready for performing a second step of the process, i. e. a first desiliconizing operation of silico-chromium rich in silicon. In the said embodiment of the invention, the material sequence of the three steps of the process coincides with the one which characterises the scheme of the invention which has been described hereabove to set forth the invention.

Second embodiment.—An appliance is used which is the same as the one defined in relation with the first embodiment. In contradistinction with what has been the case in the first embodiment, the silico-chromium (intermediate alloy) which has been partially desiliconized by the second step of the process (first desiliconizing operation) is cast, allowed to solidify, crushed and stored in a storing place (not shown) after each operation. Partially desiliconized silico-chromium in crushed state is thus at hand in a permanent manner.

The sequence of the operations is in such a case, the following: a quantity of molten slag (primary slag having as a basis chromium-ore and lime) is taken from the slag fusion furnace 2 and is introduced into the intermixing apparatus 3 at the same time as partially desiliconized silico-chromium in crushed state taken from the storing place (intermediate alloy). An energetic intermixing is performed between the slag and silico-chromium and this intermixing desiliconizes the silico chromium to its final content of silicon, thus carrying on the third step of the process (second desiliconizing operation). The ferro-chromium thus obtained is cast after separating from the partially exhausted slag, the latter being kept in the apparatus 3 (intermediate slag). The necessary quantity of silico-chromium (primary alloy) is then taken from the silico-chromium furnace 1 and is introduced into the apparatus 3. The mixture of silico-chromium and slag is energetically intermixed therein in order to realize the total exhaustion of the slag as concerns Cr_2O_3 (second step of the process). Intermixing having been terminated, the slag is discarded in exhausted condition and the partially desiliconized silico-chromium (intermediate alloy) is cast; it is allowed to solidify and it is crushed and stored in view of being further treated later on.

It is to be remarked that in that second embodiment of the invention the sequence of the two desiliconizing steps in the intermixing apparatus is reversed in respect to the sequence which is followed in the first embodiment.

Third embodiment.—The appliance which is used is the same as the one hereabove described in relation with the first and second embodiments. As in the second embodiment the silico-chromium which has been partially desiliconized (intermediate alloy) during the performance of a second step of the process (first desiliconizing operation) is separated from the exhausted slag and it is cast, allowed to solidify and stored. The sequence of the operations is the following: Partially desiliconized silico-chromium (intermediate alloy) is taken from the storage place and it is introduced in the slag fusion furnace 2 at the same time as the substances which compose the slag, principally chromium ore and lime. When these various substances are melted (primary slag and intermediate alloy) they are caused to react upon each other during such a long period of time that the final content of silicon which is wanted for the ferro-chromium alloy is reached (third step of the process)—second desiliconizing operation—the amount of chromium ore introduced in the slag fusion furnace 2 being so chosen that a relatively large quantity of Cr_2O_3 is left in the slag when the operation is ended. The ferro chromium obtained is separated from the slag and cast. The remaining slag (intermediate slag) is taken out of the fusion furnace 2 and it is introduced in the intermixing apparatus 3 at the same time as silico-chromium originated from the silico-chromium furnace 1 (primary alloy) and which can be charged either in liquid or in solid states. The mixture of silico-chromium and of the slag resulting from the previous operation is energetically intermixed during about two minutes, which realizes the second step of the process (partial desiliconization of the silico chromium and exhaustion of the slag as concerns Cr_2O_3 (first desiliconizing step). The exhausted slag is discarded and the partially desiliconized silico-chromium (intermediate alloy) is cast, allowed to solidify, crushed and stored in view of being further desiliconized.

In such an embodiment, as in the precedent one, the order of sequence of the two desiliconizing operations is timely reversed with respect to the one in which they follow each other in the first embodiment of the invention.

Below is given a detailed and still more specific example of carrying on the process according to the process of the invention.

A ferro-silico-chromium (primary alloy) having the following composition:

Si=45%
C=0,030%
Cr=40%

the remainder being substantially iron, was manufactured in a silico-chromium electric furnace, by starting of a charge comprising:

	Parts in weight
Chromium ore	about 150
Quartz	190
Coke	98

On the other hand, a mixture comprising 103 parts in weight of chromium ore and 80 parts in weight of lime, was melted in a slag fusion furnace and constituted a desiliconizing slag (primary slag).

In an intermixing apparatus such as the one hereabove described in relation with the first embodiment of the invention, 1500 kgs of the above said primary slag were charged together with 410 kgs of partially desiliconized ferro-silico-chromium intermediate-alloy resulting from a preceding operation according to the invention, and having the following composition:

Si=33%
Cr=51%
C=0,027%

the remainder being substantially iron. This ferro-silico-chromium had been allowed to solidify; it had been crushed beforehand so as to

wholly pass through a sieve the square meshes of which had opening dimensions of 5 mm.

After an energetic intermixing during two minutes, in the intermixing apparatus, about 560 kgs of ferro-chromium were obtained having the following composition:

Si=0,12%
C=0,024%
Cr=73,50%

the remainder being substantially iron.

The so obtained ferro-chromium which had very low content of silicon and carbon was cast as final product of the process, and the slag (intermediate slag) was left in the intermixing apparatus.

The said slag had the following composition:

Cr_2O_3=7%
SiO_2=25%
FeO=0,20%
Al_2O_3=9,50%
CaO=46%
MgO=11.50%

the remainder having not been determined by an analysis as it was of no importance to know the composition thereof.

To this intermediate slag 365 kgs. of molten ferro-silico-chromium taken from the silico-chromium electric furnace above referred to and the composition of which has been given hereabove (primary alloy), were added in the intermixing apparatus.

After two minutes of energetic intermixing in the rocking apparatus 395 kgs of partially desiliconized ferro-silico-chromium (intermediate alloy) were obtained, the analysis of which was:

Si =33%
Cr=52%
C =0,027%

This intermediate ferro-chromium was separated from the slag, allowed to solidify, crushed and stored.

The slag was then discarded; it contained but 0,5% of Cr_2O_3 and 0,14% of FeO, being accordingly perfectly exhausted as concerns reducible oxides.

RENÉ PERRIN.

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JUNE 1, 1943.
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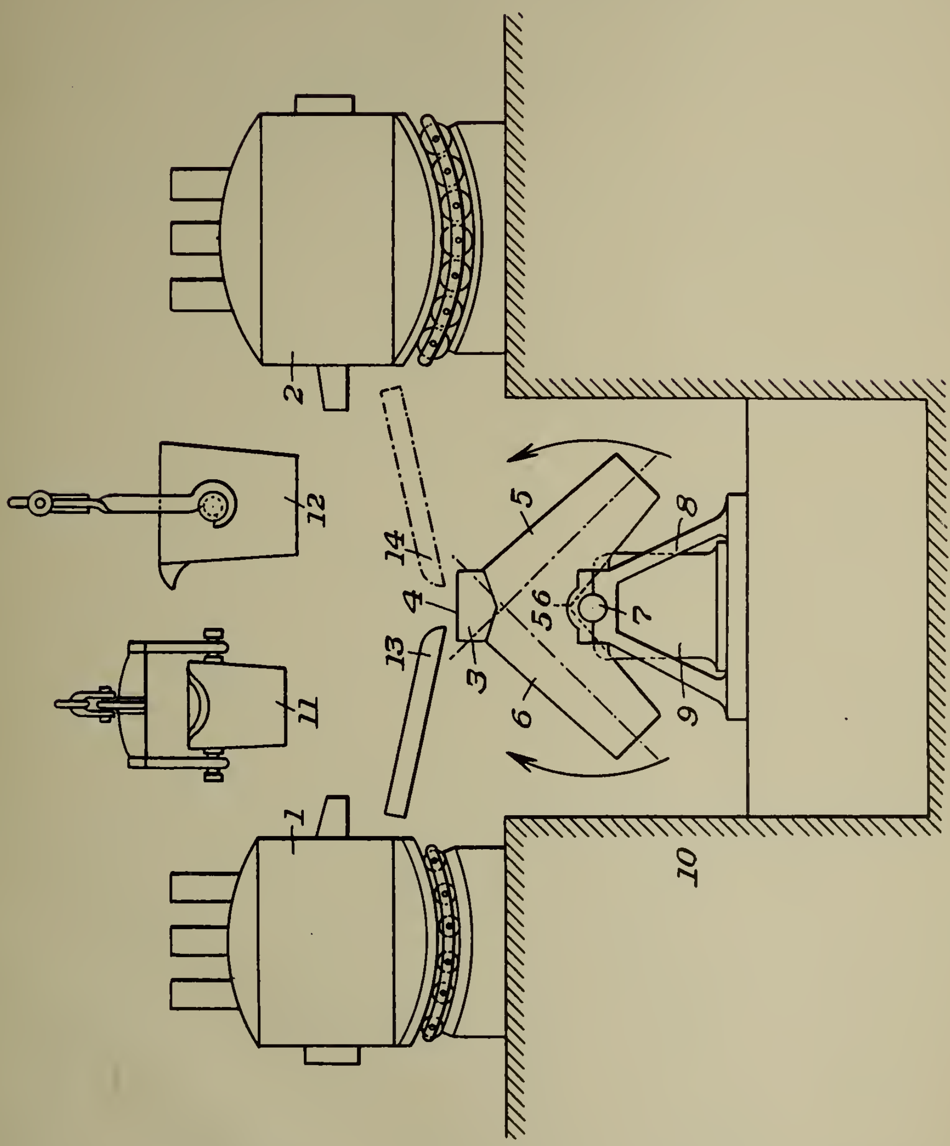

INVENTOR
Rene' Perrin
by
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His Attys.

Published June 1, 1943

Serial No. 356,818

ALIEN PROPERTY CUSTODIAN

REGULATING DEVICE, SPECIALLY FOR FUEL INJECTION PUMPS OF INTERNAL COMBUSTION ENGINES

Heinz Links, Gaggenau/Baden, and Samuel Meiswinkel, Stettin, Germany; vested in the Alien Property Custodian

Application filed September 14, 1940

The invention relates to a regulating device, specially for the improved regulation of the injection of fuel which is being conveyed by means of injection pumps to the combustion chamber of internal combustion engines, and to a construction of a suitable regulating member for this purpose, specially a regulating slide valve. The object of the invention is above all, in adaption to the ignition delay, to prevent a too sudden injection of the fuel into the combustion space of the engine, and in connection therewith a too sudden inflammation of the fuel. Specially for this purpose the cross section of the fuel passage shall be opened irregularly and that, first a little and later more.

It is well known that at given cylinder contents of the engine, the fuel quantity injected during the time corresponding to the ignition delay should not surpass a certain value in order to guarantee a shock-free course of the combustion, and therewith a sufficient quietness in running. Up to the present time the regulating devices allow under circumstances that too much fuel passes in the time unit, at the beginning of the injection, so that also in the running of the engine a certain non-uniformity is to be noted.

By means of the invention this disadvantage may be removed by the fact that in a primary section of the opening period, corresponding to the ignition delay, only a comparatively small quantity of fuel is let through to the injection piping or to the injection nozzle, for instance by means of providing instead of a cylindrical, a conical shaped regulating groove in ring form, in the regulating slide valve, forming the connection between the pumping space and the injection pipe, and a correspondingly slow increase of the passing fuel quantity ensuing in conformity to the steepness of the cone.

A further possi[illegible]ty for the realisation of the invention consi[illegible] instance in the fact that the regulating [illegible]alve is provided with regulating bores [illegible] into action one after the other, and tha[illegible] rably in such manner, that between a small[illegible] egulating bore coming first into action, and a following larger regulating bore, such a distance is provided that in the opening motion of the regulating slide valve the larger regulating bore will only be given free after a certain stroke, when the opening action of the smaller regulating bore is already finished. Eventually several regulating bores may be provided, being displaced with respect to each other, and being graduated in their cross sections.

In the drawing the object of the invention is shown in several types given by way of example.

Fig. 1 shows the upper part of a fuel injection pump with a well known type of a regulating slide valve which is to be improved.

Fig. 2 shows a regulating slide valve with radial transverse channels, being displaced with respect to each other.

Fig. 3 shows a regulating slide valve with conically shaped ring groove, and

Fig. 4 shows a regulating slide valve with radial transverse channels, an axial distance being provided between the topmost and the next following passage channel.

In Fig. 1, **11** indicates the upper part of an injection pump casing, being set onto the (not shown) pump casing proper, and being secured to it. The pumping space extending into the upper casing part, is formed by a bore **10** containing simultaneously the regulating slide valve **15**. The latter is provided with an extension **16** onto which the valve **17** is adjustably screwed. It is located in a compression space consisting of the part spaces **24** and **14**, being formed by means of the casing part **11** and by the casing part **12** which is set onto it and secured to it, and to which the injection pressure pipe **13** is connected, leading to the injection nozzle. A spring **18** presses the valve **17** onto its seat, and the regulating slide valve into its lower position.

The regulating slide valve **15** is provided with a center bore **26** and a ring shaped groove **22**, being shaped cylindrically in the type shown in Fig. 1, and being connected by means of a transverse bore **25** with the center bore **26**. The upper edge of the ring groove **22** having a distance x from the regulating edge **23** in the casing **11**, as drawn here in the lower position of the slide valve.

The manner of operation of this known arrangement is the following:

The fuel sucked into the pump pressure space **10**, by means of the pumping piston, in a well known manner, presses in the pressure stroke of the piston the slide valve **15**, and with it the valve **17** upwards, and comes thereby through the center bore **26** of the pressure slide **15**, and through the transverse bore **25**, into the ring shaped groove **22**, and from there (after lifting the pressure- or regulating slide valve **15** and the valve **17** by means of the fuel, being put under pressure by the pumping piston, by the amount x, and therewith after shifting the regulating edge **23** by the upper edge of the ring shaped groove **22**) through the pressure space **24** and **14** into the injection pipe **13**, leading to the injection

nozzle. With this type with cylindrical ring shaped groove 22 the cross section of the passage is opened comparatively quick, causing a sudden combustion and a sudden pressure increase in the combustion space of the engine.

According to Fig. 2 the conveyance of the fuel ensues into the pressure pipe from the pressure space 10 over the longitudinal bore 26 and the transverse passage channels 30, 31, 32 to the pressure space 24, the channels 30, 31, 32 being arranged in any desired radial direction in steps, but without axial distance from each other. As in the beginning only the comparatively narrow bore 30 will be opened, in opposition to the well known arrangement according to Fig. 1, first a comparatively throttled passage of the fuel will be guaranteed, so that the danger of a too strong and too sudden increase of pressure in the combustion space is lessened.

Still more favorable results may be obtained by the type of the regulating slide valve according to the Figs. 3 and 4.

With the type according to Fig. 3 the ring shaped groove 22 is, in opposition to the purely cylindrical form shown in Fig. 1, of conical shape, the basis of the cone being situated towards the regulating edge 23. The steeper the cone, the slower the increase of the passing fuel in the time unit.

With the type shown in Fig. 4 the topmost transverse bore 30 with an axial distance E from the next lower and larger bore 31 is arranged, differing from the one according to Fig. 2, in such a manner that first, only the smallest transverse bore will be given free, with the consequence that within a time unit corresponding to the ignition delay, only a quantity of fuel excluding a too sudden pressure increase may pass through. Only with further lifting of the regulating slide valve 15 also the second and larger transverse bore 31, and immediately subsequent the third and largest transverse bore 32 is laid free.

Besides the advantage of more favorable combustion, furthermore in consequence of the more rational conveyance of the fuel, a considerable saving of fuel will be reached.

HEINZ LINKS.
SAMUEL MEISWINKEL.

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H. LINKS ET AL
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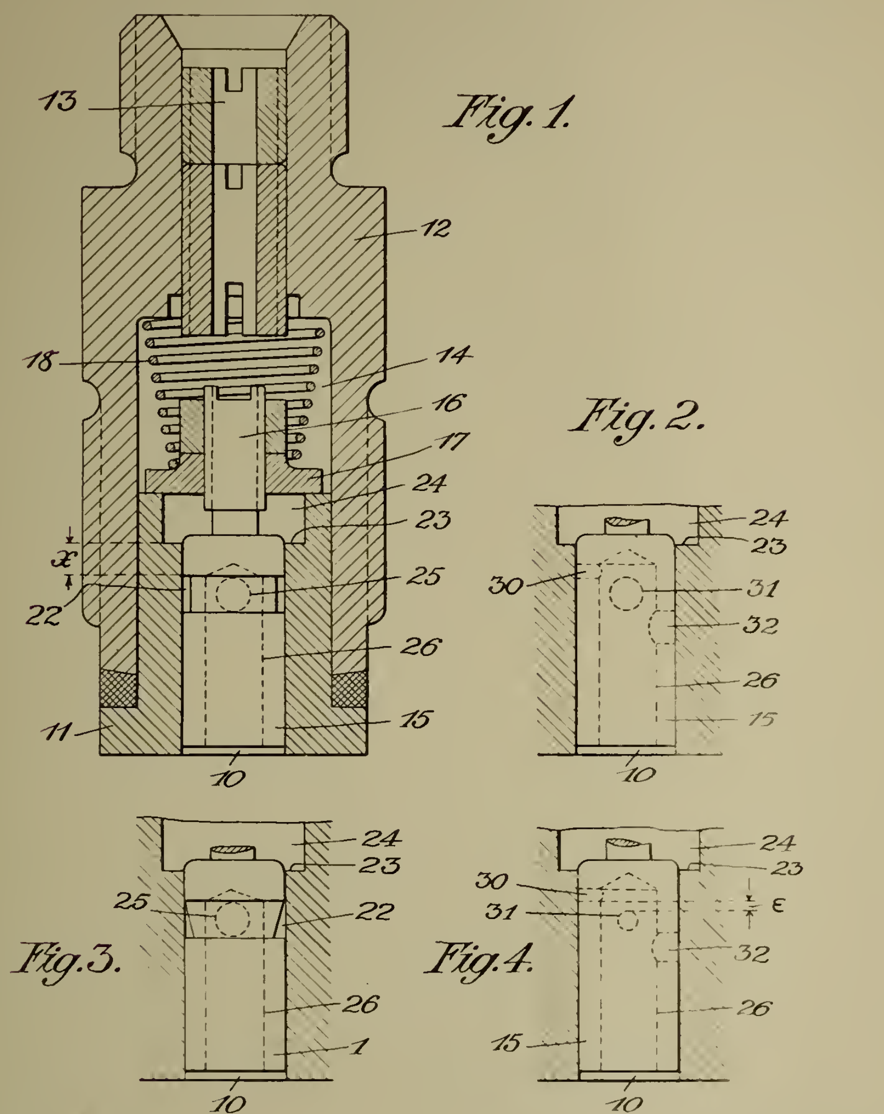

INVENTORS
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ALIEN PROPERTY CUSTODIAN

ADJUSTABLE JAW FOR SKIS

Hans Hörack, Immenstadt, Germany; vested in the Alien Property Custodian

Application filed September 23, 1940

Skis are known in which the adjustable jaws are secured in their clamping position by a bow adapted to be lifted up and folded down. Owing to the improvement according to the invention these bows are omitted and shifting of the jaws when removing the boot is prevented.

According to the invention the cover plate is constructed so that it can be lifted and lowered and serves as holding device, a locking being provided for this cover plate. Owing to the invention no additional elements, such as for instance bows, are necessary. Automatic detaching of the cover plate is prevented, so that the movable elements of the jaws are securely held in their position. The cover plate is further secured by the sole of the boot against accidental detaching.

According to the invention one of the racks is fixed, whereas the other rack is movably connected with the cover plate. Consequently, only one of the two racks need be shifted or secured in position. The locking device is arranged on the cover plate and so that this cover plate cannot be automatically detached. Holders for the sole are further arranged on the jaws so that no holding strap for the toes is necessary. The sole holders can be easily adjusted in accordance with the thickness of the sole, so that the boot is always strongly pressed against the cover plate. The pressing surface of the sole holder is curved so that notwithstanding the strong pressing of the sole on the cover plate the sole of the boot can carry out a rolling movement. The portion on the outer side of the device for securely holding the sole is further constructed as rope guide. For adjusting the jaws it is therefore no longer necessary to loosen any fixing screws, and no tool is required.

An embodiment of the invention is illustrated by way of example in the accompanying drawing in which,

Fig. 1 is a vertical longitudinal section through the ski on line A—B of Fig. 2,

Fig. 2 is a top plan view of the ski,

Fig. 3 is a cross section on line C—D of Fig. 2,

Fig. 4 is a section through the sole-holding device on line E—F of Fig. 1,

Fig. 5 shows the sole-holding device in elevation.

A case-like base plate **3** is fixed on the ski **1** by means of screws **2**. The rack **5** at the front end of the base plate is fixed and the curved toothed edges of the parts of the ski jaws engage with this rack. The rack **6** is movably arranged in the rear part of the casing in that a longitudinal slot **7** can shift on the sleeve **8** of the screw. The rack **6** is connected by hinges **9** with the cover plate **10** which in turn engages with its downwardly bent edge **11** over the base plate **3** and has noses **12**. The edges **16** on the outer side of a vertical slot **14** provided in the vertical part **13** of the ski jaw are bevelled. In the slot **14** a sole holder **18** is guided which has a prismatic projection **17** engaging in the bevelled portion of slot **14**, so that it can be shifted in vertical direction but not turned. A screw **19** with conical head **20** serves for securing the sole holder in the adjusted position. The pressure surface of the sole holder is curved in order that the boot can roll. The conical head **20** of the screw **19** has a projecting rim **21**, so that the conical part **20** of the screw can serve as rope guide.

The operation of the ski jaw is as follows: The cover plate **10** is raised into the position shown in Fig. 1 and then pulled to the right or forward, the rack **6** participating in the movement, so that the rack disengages from the curved toothed edge of the ski jaw. The boot is then placed between the two jaws and the jaws are brought into the correct position. During this movement the jaws are pressed in rearward direction against the toothed parts **5** by which they are secured in position. The cover plate **10**, together with the rack **6**, are shifted again so that the rack **6** comes into engagement with the toothed edges of the plate part **4**, the jaws being thus absolutely secured in their position. The boot is then pulled out without altering the position of the jaws, whereupon the cover plate is oscillated in the direction of the arrow **22** in Fig. 1 and tightly pressed downwards, so that the inward projection **12** of the cover plate **10** comes into engagement. Indentations **23** in the side edge of the cover plate enable unimpeded oscillation of the cover plate along the sole holders **18**.

The ski is now ready for use, the cover plate being additionally secured in its position by the boot placed onto the same. To adjust the sole holders, the conical screw has to be loosened and screwed in again after the sole holder has been adjusted according to the thickness of the sole.

HANS HÖRACK.

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BY A. P. C.

H. HÖRACK
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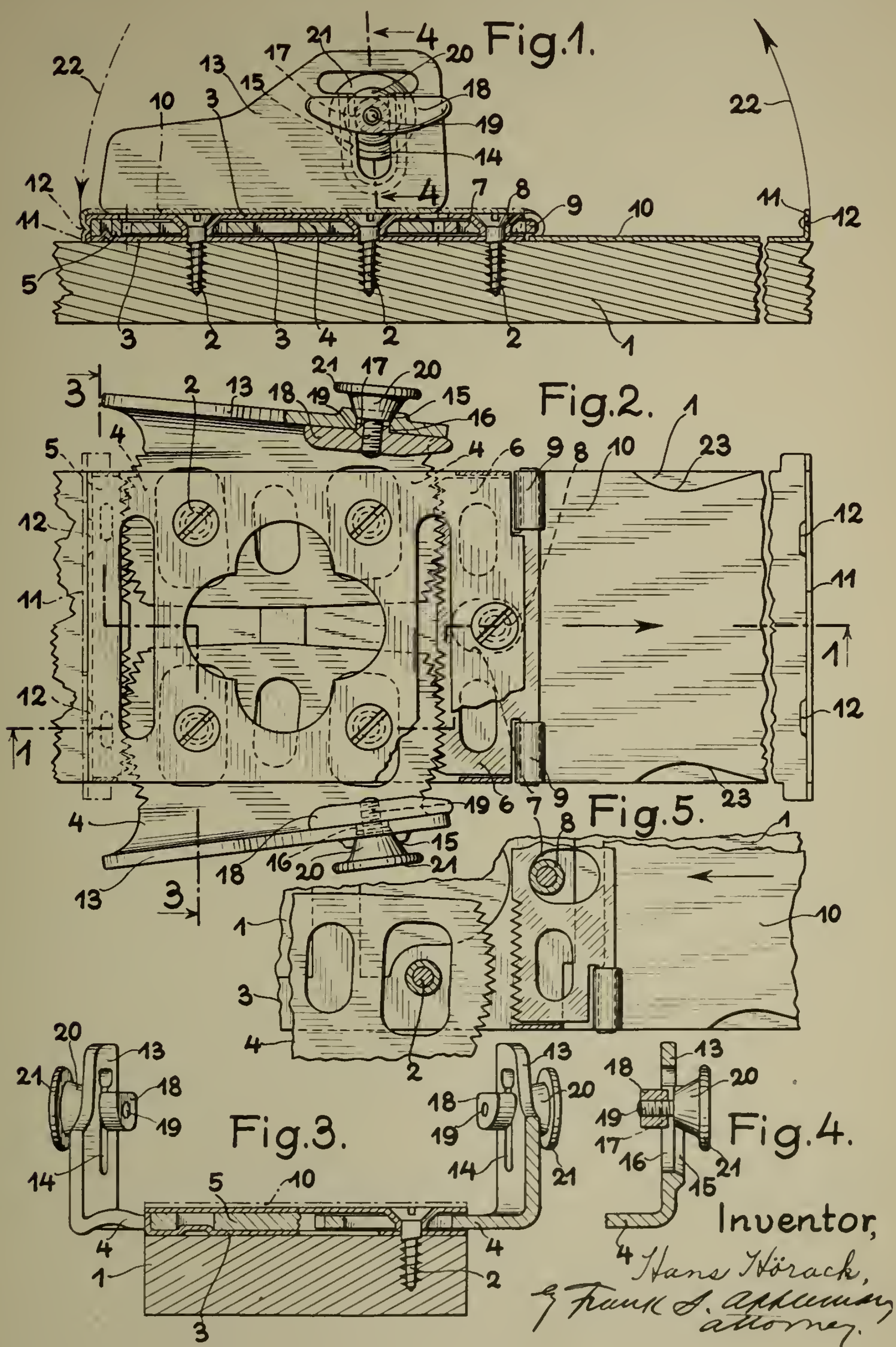

Inventor,
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attorney.

Published June 1, 1943

Serial No. 358,094

ALIEN PROPERTY CUSTODIAN

UTILISING MAIS CANE AND SORGHUM CANE

Adolfo Zajotti and Carlo Tellini, Venice, Carpenedo, Italy; vested in the Alien Property Custodian

Application filed September 24, 1940

Our invention relates to an improved process and device for utilising mais cane and sorghum cane by contemporaneously producing cellulose fibres and a medulla forage from these materials. At the present time the mais cane is for the most burned in order to destroy the larvae of *Pyrausta nubilalis* or it is used for shake-down. If used for forage, only the top portion and some residual leaves are utilised, whereas the cane is refused. The sorghum cane is generally entirely abandoned as the countrymen can not convert it, at the present state, into forage. According to the process and with the device forming the object of our invention the great mass of these materials is transformed into cellulose fibres and a medulla forage for the cattle.

According to the invention, from the ligneous portion forming the case of the cane, the cellulose is extracted whereas from the inner portion, viz. from the medulla, an excellent food is obtained which may be given alone or mixed with other foods. Hitherto it is not possible to obtain a clean separation of the two products, but it was only known to extract the fibres from the cane and to separate the two products by means of seaving. In this way it is impossible to obtain pure products; only two masses may be obtained containing the one a predominating portion of cellulose and the other a predominating portion of mark to be used as forage. Of course this was prejudicial for both the products.

The device forming the object of the present invention allows to obtain on the one hand the cellulose fibre completely free from medulla in any part and on the other hand the medulla ready for use as forage and therefore immediately to be utilised.

A device according to the invention is shown by way of example in the accompanying drawings.

Fig. 1 is a plan view and

Fig. 2 a side view of the said device;

Figs. 3 and 3*a* show in a larger scale, respectively in plan view and in side view, the slicing, turning and pressing means.

The operation of the device is as follows: The mais or the sorghum cane is introduced in suitable guides A and adduced to special cutting and opening devices C adapted to slice and open the cane so as to orient the whole outside of the cane (fibres of cellulose) downwards and the whole inner part (medulla) upwards before the canes reach a pair of cylinders B. The said cylinders provide for reducing the two sections of the cane to ribbons of a constant thickness adapted to uniformly receive the treatment of a special system of rotating blades and brushes D. The mais cane or the sorghum cane is thus transformed into ribbons of cellulose fibres, whereas the medulla, previously compressed by the cylinders B and then crushed by the rotating blades and the brushes D, is entirely separated and ready for use as an excellent forage.

By the invention are thus obtained contemporaneously three objects, viz.:

(1) The production of cellulose fibres,

(2) The production of a forage,

(3) The destruction of the larvae of *Pyrausta nubilalis*.

ADOLFO ZAJOTTI.
CARLO TELLINI.

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A. ZAJOTTI ET AL

UTILISING MAIS CANE AND SORGHUM CANE

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Fig. 1

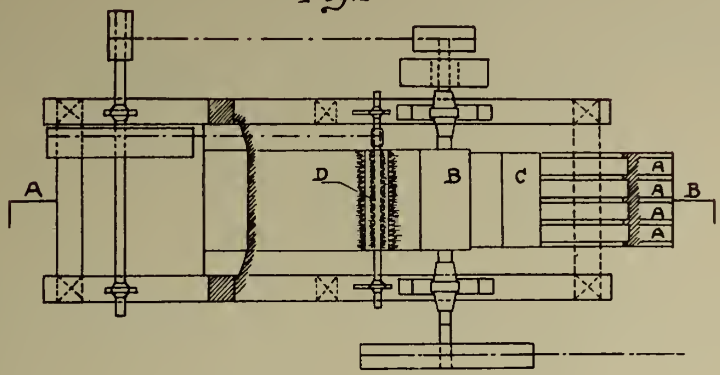


Fig. 2

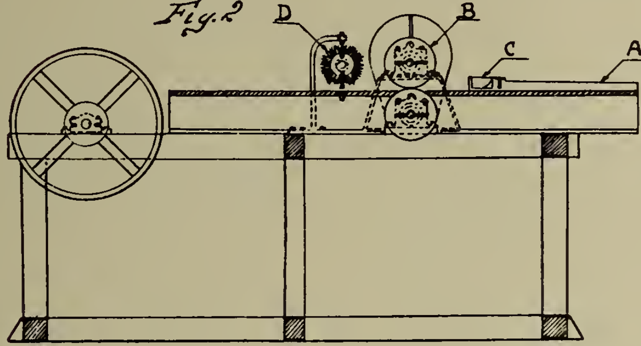


Fig. 3

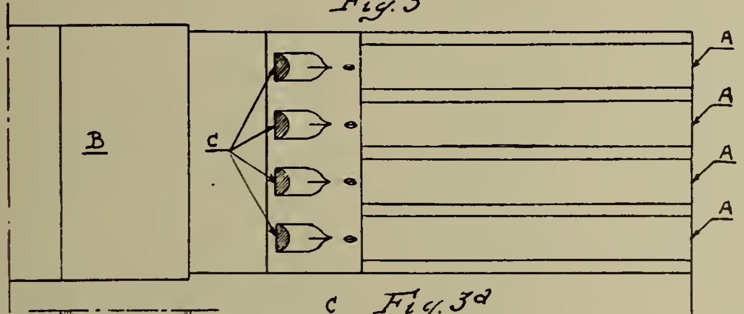
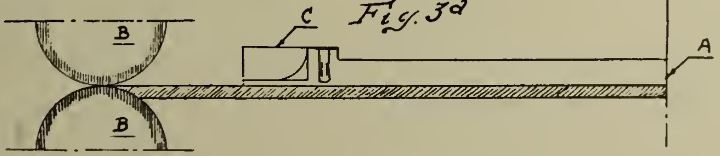


Fig. 3a



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ALIEN PROPERTY CUSTODIAN

HOLD-FAST APPLIANCES FOR HOLDING VARIOUS LAYERS OF THICK MATERIALS TOGETHER

Thea Stumpf, Francfort-on-Main, Germany; vested in the Alien Property Custodian

Application filed October 2, 1940

Appliances for holding several layers of thick material together or to hold one layer of thick stuff together with an upper layer of thin stuff are already known. These appliances consist of two buttons, which are connected by means of the shafts and cases of hinges. Other appliances of this kind are known also, in which one of the buttons is supplied with a pointed shaft, which can be inserted in the case or covered rill or raised groove of the corresponding button and kept fast there by pressure.

These already known appliances make it necessary that the material should have a passage-opening or larger hole at the place where the appliance is to be fixed, and, in addition to this the connection by hinges in the case of the first-named is disadvantageous and circumstantial while in the case of the second the pushing in of the pointed shaft on the one button when the layers of material are to be laid together has been shown in practice to be hardly suitable.

This invention avoids the deficiencies of these already known appliances for holding thick materials together.

In the accompanying drawing the various constructions (forms of construction) of the hold-fast appliance are demonstrated in detail.

Fig. 1 shows the first form of construction in connection with two layers of stuff lying one upon the other in detail.

Fig. 2 is a full view of the same seen from above.

Fig. 3 is a full view of the under half of the appliance, and

Fig. 4 is a full view of both parts of the appliance, for the better understanding of which the same is shown without the layers of material.

Fig. 5 shows a diametrical view of the appliance, in which the pin with adherent chain is shown drawn through the holes.

Fig. 6 shows the pin alone, with chain.

Fig. 7 shows a slightly altered form of the under half of the hold-fast appliance.

Fig. 8 is the same in diameter, having one of the little metal cover-plates open;

Fig. 9 shows the upper full view of another variation of the under-half of the hold-fast appliance.

This new fixing contrivance for thick stuffs which is shown in Figs. 1–4 with details shown in Figs. 5 and 6 consists of two fine shafts **1**, each of which has on the under end a sort of rectangular bend **2** (Fig. 1). The upper parts of these shafts are connected together by a very fine little chain **3**. On the one end of this little chain is a somewhat larger end-link or ring which is intended to hinder the slipping-through of the other shaft **1** when brought in connection with the hole of the button **5**. In order to connect the bent shafts **2** with the under-plate or disc of the appliance, the latter is provided on its upper side with little rills or groove which form a cover for the pointed ends of the shafts. In addition to this, this under half (round disc **6**) of the appliance is provided with two little metal cover-plates which are hinged on at **8**. These cover-plates **7** are also provided at **9** with corresponding raised grooves or rills so that when they, the plates are closed the bent shafts **2** are firmly fixed and hold fast. Little points **10** on the cover plates grasp at the same time by closing into corresponding holes of the under-part, disc **6**, of the appliance.

When various stuff-layers, *a* and *b*, are to be connected, the fine shaft **1**, which has the slender chain **3** with the end-ring **4** is pierced through the stuff-layers to be connected and its bent end **2** is driven into the raised groove of the under-half **6** (disc) of the appliance and then the cover-plate **7** is closed. The fine points **10** of the cover-plate **7** grasp into the disc **6** and so secure a firm connection of the cover-plate **7** of under-half **6** with the bent shaft **2**. Then the other fine shaft **1** with its bent end **2** is driven through the upper button **5** with the holes and then through the stuff-layers *a* and *b* in the same way as the first shaft has been driven and is fixed in the same way into under-half or disc **6** and is also held fast and secured in the same way by the cover-plate **7**.

One can also proceed in the following manner: If buttons with two holes or with shanks are to be used and so form the upper half of the contrivance, only one shaft **1** with bent end **2**, chain **3**, and ring **4** need be used (compare Figs. 5 and 6). In this case the placing of the shaft on button **5**, see Fig. 5, is accomplished as shown in the sketch and then button and shaft are connected with the under-half (disc) in the aforesaid manner after the layers of material have been pierced through.

Should the upper button to be used have four holes, two of the hold-fast appliances can be used side by side. Such an arrangement is shown in Figs. 7 and 8. In this case the under-half **6** (disc) has two transposed cover plates **7** which have a common axis or hinge-arrangement and are constructed in the same manner as in the first case and which also close fast over the bent ends **2** of the shaft **1** and are also firmly secured by the points **10** of the under-half (disc) **6**.

The variation which is shown in Fig. 9 has on the under-half (disc) 6 of the contrivance two metal coverplates 7 each of which is provided with a revolving hinge 11 and has the form of a quarter of the disc. These are so constructed that they can be raised or levitated in the direction I shown by the arrow so that their top 13 can be brought to rest on point 12 of the disc 6. When the hold fast appliance is to be opened again the cover-plate must be taken hold of again at its top-end 13 and shoved back again from the point 12 of the button 6 in the direction shown by arrow II. These cover-plates have, further little grooves 14 which correspond with similar grooves in under disc 6 when closed. This variation is also provided on its coverplates with raised grooves or rills 9, constructed in accordance with the thickness of the bent points 2 of the shafts 1.

THEA STUMPF.

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JUNE 1, 1943.

BY A. P. C.

T. STUMPF

HOLD-FAST APPLIANCES FOR HOLDING VARIOUS LAYERS OF THICK MATERIALS TOGETHER

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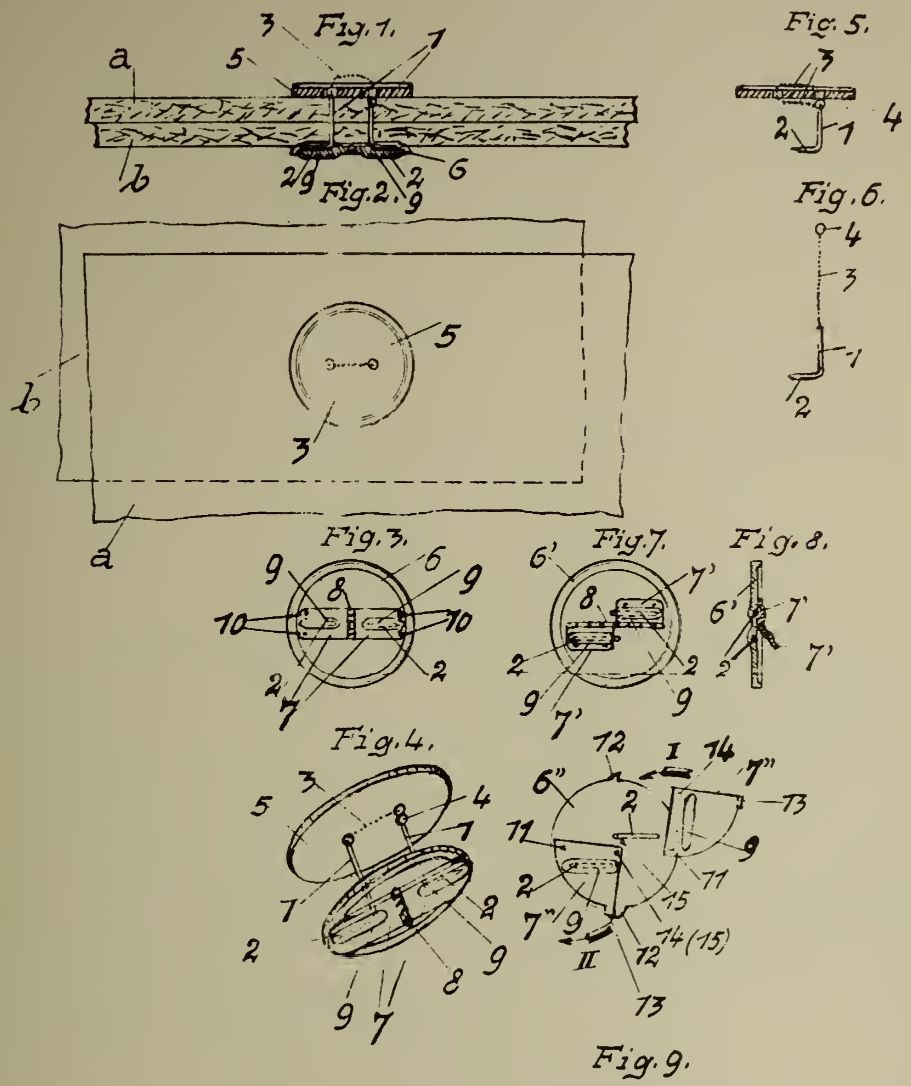

Inventor:

Thea Stumpf

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ALIEN PROPERTY CUSTODIAN

ELECTRON TUBE GRID

Max Vantler, Berlin, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 3, 1940

The present invention relates to electron tubes and more particularly to the construction of a grid in such tubes.

In amplifying electron tubes the temperature of a grid is not allowed to become so high that emission layers on the grid (which are nearly impossible to be avoided) are able to emit electrons. It is well known to improve the cooling of a grid usually consisting of molybdenum wires by using copper rods as supporting means, and also to provide these rods at their ends with cooling wings also made of copper. It is also known to build the supporting rods of a copper core with a nickel sheet.

In practice, however, it has been observed that this way of cooling is not sufficient on account of the bad heat conductivity of the molybdenum wires and their free length.

According to the present invention the cooling of the grid is considerably improved by covering the molybdenum with a coating of copper or silver. That may be done mechanically or galvanically before the wire is wound upon the rods. Applicant prefers, however, to coat the complete grid galvanically.

By the described coating the longitudinal heat conductivity of the grid wires is sufficiently increased and, at the same time, the advantage is obtained that the coating, especially of copper, is less able to become emissive than molybdenum.

MAX VANTLER.

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ALIEN PROPERTY CUSTODIAN

ESCAPE BOAT FROM SUBMARINES

Jean Jacques Bessire; vested in the Alien Property Custodian

Application filed October 14, 1940

This invention relates to a contrivance for allowing the whole crew to escape from submarine.

Unfortunately it happens often, also in peace time, that a Submarine can not emerge and the whole crew or a great part of same is lost. It is sufficient to remember the British Submarine Thetis, sunk in the Channel, from which, although prominent upon low-water, only two men could escape and in very bad conditions, whilst about hundred died inside.

There are a great deal of patented rescue contrivances, some of which, tried at leisure and without dangers anxiety, may seem suitable. But all these contrivances must be fitted up in great hurry and give escape only one by one man, which, being without navigations means, can only be saved if a ship or the shore are in the neighbourhood.

The contrivance of the present invention removes all these difficulties, being always ready to start and allowing the whole crew to escape at once. It consists of one, two or more hermetic boats, equipped with distress navigations means, fixed standing to the submarine but easily to be loosed immediately. Such boats could be utilized not only for rescuing from sunk submarine but also for clandestine convoy of troops.

The peculiarity of the invention consists in the system of fixing these boats on the submarine and specially in the quite new system of gaps giving easily passage from Submarine to the Escape Boat. All these contrivances are actuated from inside of the Escape Boat, even if Submarine should be much inclined.

The annexed three tables give a schematical exemplification of the contrivance of this invention.

Fig. 1 represents a longitudinal section of the escape boat. Of the Submarine are indicated only a part of the covering plate and one of the four rack bars. Of course each Escape Boat can be hoisted installed and fixed only if the submarine emerged is moored near a crane.

Upon the four rack bars **20** (Fig. 5) act four toothed wheels **19**, which are driven by two endless screws **21** and a crank **26**.

In each Escape Boat there are two or more grappling bolts **6** which are turned and strained in loops **7** of Submarine by grasp **4** and screw **3** both inside of the Escape Boat.

The most important part of present invention is the special and quite new construction of the gaps, (Figures 8 and 9). On the Submarine is fixed a cannular protuberance **9**, with a hole sufficient to allow easily passage of men and ending in a funnel-shaped surface *g* which is watertight filled by a reversed bell shaped cover **10**. The exterior face *f* of the protuberance **9** is conical and corresponding to the orifice **11** of the Escape Boat; on the top there is a cylindrical screw.

The orifice of the Escape Boat has a conical surface **11** exactly fitting to the exterior surface *f* of the protuberance **9**. On the top of **11** there is a collet **16** (Fig. 9) with rips **15** (Fig. 8), on which turn the bolts **16**. A cover **12** (Fig. 8) having a collet **14** corresponding exactly to collet **15** lays on the bottom of the Escape Boat.

By assemblage the Escape Boat is hoisted by crane and lowered between the rack bars until the protuberance **9** is totally inside of the orifice **11**. Then the grappling bars are turned to grasp in the loops **7** and strained by screws **3**. Afterwards a ring **13** is screwed upon the top of the protuberance **9** in order to force together the bell surface **11** on the corresponding surface *f*. The gap becomes watertight.

The bell shaped cover **10** remains always in place, even in navigation, to prevent the danger of Submarine's inundation if Escape Boat should leak in consequence of impact.

In the moment of the danger the crew operates as follows: the bell shaped cover **10** is pushed by hands and overthrown inside of Escape Boat. After passing through the gap the crew replace the bell shaped cover **10** in its funnel-shaped hole, the ring **13** is unscrewed, the cover **12** is placed over the collet **15** and fixed to it with bolts **16** strained with screws **17**, the grappling bars **6** are loosened and turned out of loops **7** and the toothed wheels **19** are worked through endless screws **21** and crank **26**. As soon as the water penetrates between Escape Boat and Submarine the hydrostatic pressure accelerates rapidly the emersion of Escape Boat.

Of course the Escape Boat even with the crew and equipment must have a specific weight less than water otherwise it could not float. This hydrostatic push must be compensated with ballast. Specially for clandestine convoy, when submarine must start immediately after Landing Boat is loosed, it will be necessary to throw away this extra ballast in the moment of Boat loosing from Submarine. This can be done easily if extra ballast is attached to the Submarine or to the Boat with screws to be worked from inside.

The number, the size and form of the Escape Boats must be in accordance with the size and the form the Submarine to which they should be fixed.

Landing Boats should be larger as Escape Boats and have an extra ballast.

JEAN JACQUES BESSIRE.

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J. J. BESSIRE
ESCAPE BOAT FROM SUBMARINES
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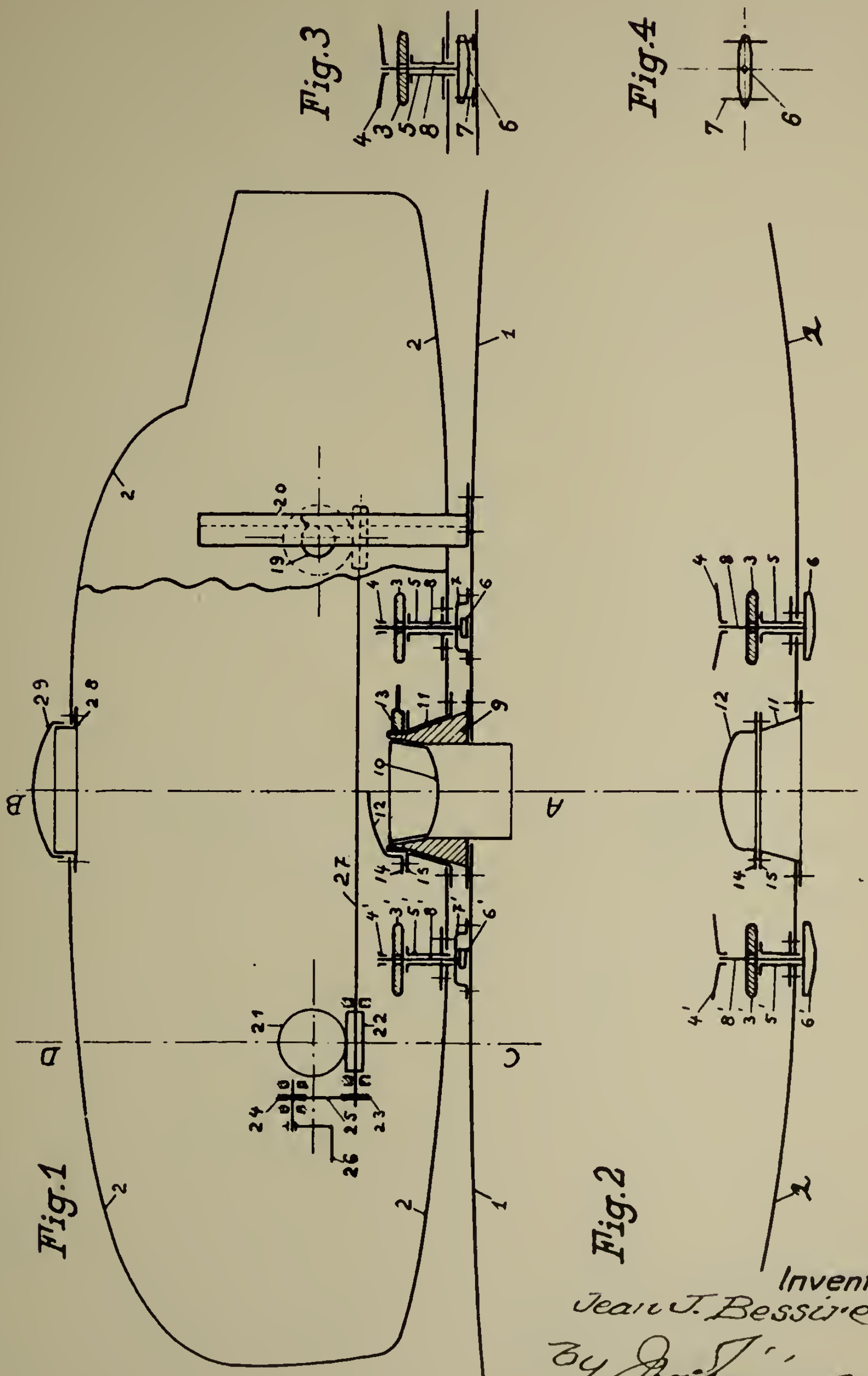
3 Sheets-Sheet 1



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JUNE 1, 1943.

BY A. P. C.

J. J. BESSIRE

ESCAPE BOAT FROM SUBMARINES

Filed Oct. 14, 1940

Serial No. 361,134

3 Sheets-Sheet 2

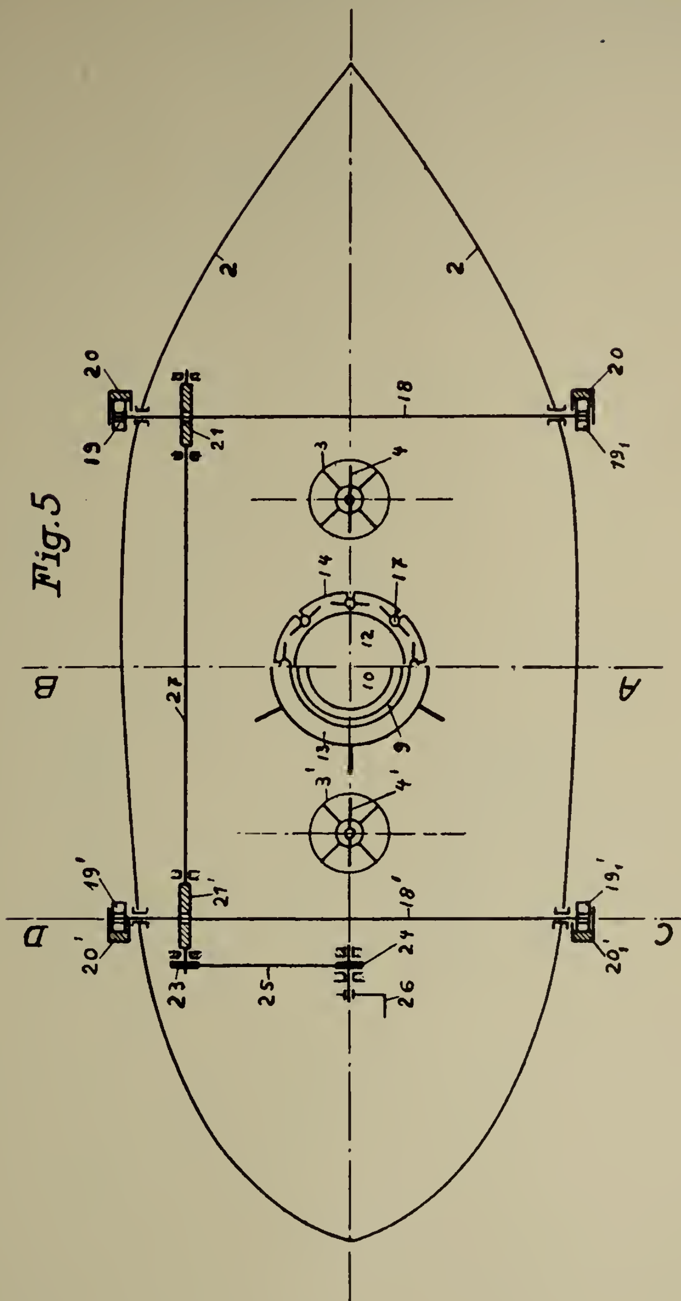

Fig.5

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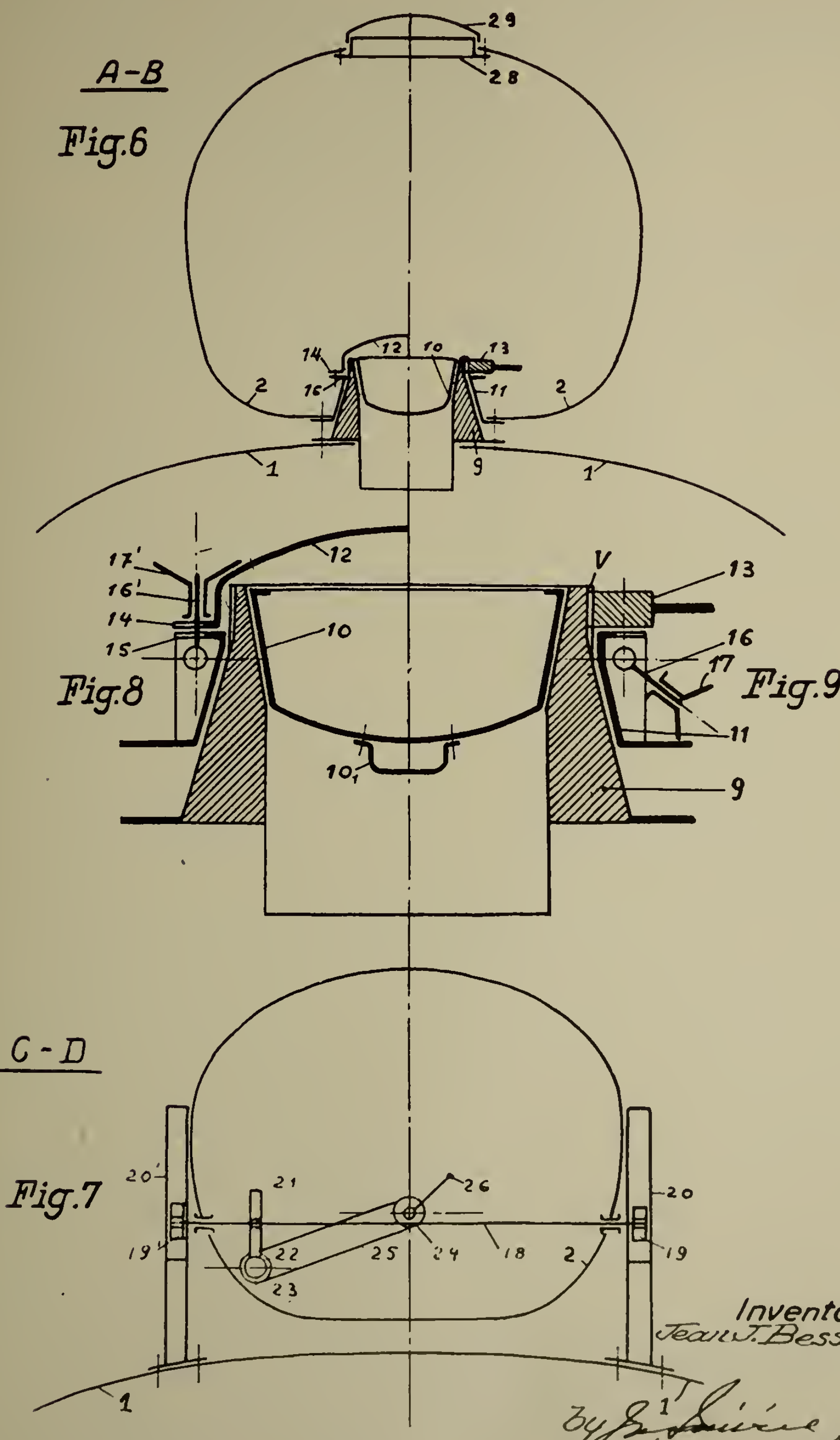

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By [signature] Atty.

Published June 1, 1943

Serial No. 362,426

ALIEN PROPERTY CUSTODIAN

STEERING COLUMN ARRANGEMENTS FOR AIRPLANES

Johann Haseloff and Erich Wessel, Dessau, Germany; vested in the Alien Property Custodian

Application filed October 23, 1940

This invention relates to improvements in steering column arrangements for airplanes. It is customary at the present time to provide a steering column which projects upwardly in front of a pilot's seat and has a control member, consisting of a handwheel or other suitable handle, either mounted directly adjacent the upper extremity of the column, or else an arm pivoted thereadjacent and adapted to project laterally from the column so that the control member mounted towards the outer end of the arm may be readily turned over to a co-pilot seated to one side of the pilot. In either case however the column interferes with the pilot's range of vision in the direction of flight, and while this is sometimes detrimental for a commercial pilot it is a far greater drawback for a pursuit pilot who has to watch sighting devices and at the same time steer a desired course.

It is an object of the invention to provide a steering column arrangement which enables a pilot to obtain an unobstructed range of vision in a forward direction and still permits the use of control members mounted directly adjacent the columns, or on intermediately positioned arms supported for pivotal movement so that the control members carried thereby may be readily turned over to a co-pilot seated to one side or the other of the pilot. Thus we aim to provide a steering column arrangement which permits such uninterrupted range of vision that a pilot may comfortably operate sighting devices and the like while steering a desired course.

Another object of the invention is to provide a steering column arrangement including two laterally spaced columns separated at least towards their upper extremities and connected for rotation about a common axis, so that ample space is provided to afford the pilot a broad range of vision between the said columns. The invention contemplates the use either of two columns separated throughout their entire height or having their upper portions only separated. In the latter case the separated columns may be integral either with a common member the upper portion of which is centrally and vertically slotted, or with a common member whereon the separated columns consist of two upwardly proecting branches disposed in the form of the upper part of a Y.

We will now proceed to describe these three preferred forms of the invention with the aid of the accompanying drawing, in which:

Figure 1 illustrates a front elevation of one form of our steering column arrangement wherein both columns are separated throughout their entire height, and on this view we have also indicated a modified arrangement wherein the columns are substantially in the form of branches of a Y.

Figure 2 shows another modification wherein the two columns extend upwardly from a common member which is vertically and centrally slotted from the top.

Referring first to Figure 1, 3 is a hollow shaft suitably supported for rotation as in bearings 3*a*. Fixed upon the shaft 3 are two spaced, parallel columns 1 and 2 which may also be tubular. Mounted on pivot members 4 and 5 carried by the upper extremities of the columns 1 and 2 are arms 6 and 7 respectively, the latter being also usually hollow. Mounted on other pivot members 8 and 9 on the outer extremities of these arms 6 and 7 are control members or handles 10 and 11 respectively. Suitable connecting means, such as chains 14 passing around rollers 15, extend through the arms 6 and 7, the column 1 and 2 and the shaft 3 to connect the control members 10 and 11 so that movement of one member imparts a corresponding rotary movement to the other. Any suitable conventional means (not shown) may be used to impart movement to the part, or parts, to be moved by rotation of the members 10 and 11. It will thus be seen that rotation of either control member 10 or 11 moves the other member correspondingly, and that either arm 6 or 7 may be independently swung about its pivot member 4 or 5, as for instance the arm 7 may be swung to the position indicated at 7*a* to bring the control member to its position 11*a* so that it may be readily handled by a co-pilot seated to the left of the pilot.

If desired, any desired means (not shown) may be provided for locking the arms 6 and 7 against pivotal movement relative to their respective columns 1 and 2, and also for locking the control members 10 and 11 against pivotal movement relative to their respective arms 6 and 7.

In the other modified embodiment indicated in the same view, Figure 1, the column member consists of a lower portion 20 fixed upon the rotary shaft 3 and terminates at its upper extremity in outwardly inclined columns 1′ and 2′ disposed in the form of a Y. In this arrangement obviously the chain 14 passes directly from the column 1′ to the column 2′.

Figure 2 shows a further modification which is primarily adapted for use in cases where it is not necessary to provide arms to permit the lateral swinging of the control members. In this case the

column member 3′ fixed upon the shaft 3 is centrally and vertically slotted from the top to form two separated colmns 1″ and 2″ between which a gap 12 is thus provided to afford the range of vision desired. In this case the control members 10′ and 11′ are directly pivoted adjacent the tops of the columns 1″ and 2″ by pivot members 8′ and 9′ respectively.

It will thus be noted that in all embodiments provision has been made for an ample range of vision between the two steering columns and the pilot is permitted a clear and unobstructed view ahead both to facilitate navigation and also to permit the operation of sighting mechanisms with greater ease and accuracy.

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J. HASELOFF ET AL

STEERING COLUMN ARRANGEMENTS FOR AIRPLANES

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Serial No. 362,426

Fig.1

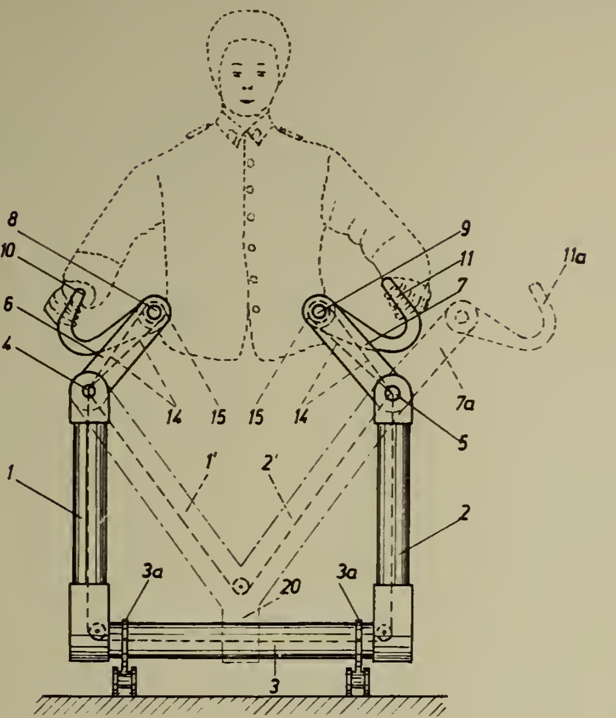
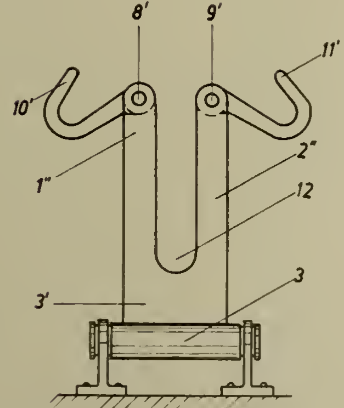


Fig.2



Inventor:
Johannes Haseloff
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by Gerald J. Baldwin
their Attorney

Published June 1, 1943 Serial No. 365,264

ALIEN PROPERTY CUSTODIAN

PROCESS FOR PRODUCING SHAPED WASHING AGENTS

Winfrid Hentrich, Rodleben B. Dessau-Rosslau, and Franz Giloy, Dessau, Germany; vested in the Alien Property Custodian

No Drawing. Application filed November 12, 1940

This invention relates to shaped washing agents and to a process for making same. More particularly it relates to the production of washing agents being composed of water soluble salts of ether carboxylic acids and water soluble highly polymeric substances.

It has been found that most valuable washing agents particularly those used for body-culture are obtained by working the water soluble salts of ether carboxylic acids of the general formula $(R.O)_x.R'.COOH$, wherein R stands for any organic radical containing no less than 4 carbon atoms, R′ for an alkylene radical that may also be substituted and x for the numbers 1 or 2, together with water soluble highly polymeric substances from vinyl compounds or polymerisation products of ethylene oxide or condensation products from aldehydes and carbon- or urea-derivatives either alone or together with other stuffs adapted for the manufacture of soap like preparations, into bars, pieces, balls, flakes, chips, films or powders.

Ether carboxylic acids of this kind are e. g. butyloxy acetic acid, i-amyloxy acetic acid, mixtures of alkoxy acetic acids obtainable from mixtures of alcohols obtained by reduction of first running acids of the paraffin oxidation or obtained as high boiling portions at the methanol synthesis, octyloxy acetic acid, dodecyloxy acetic acid, cyclohexyloxy acetic acid, tetrahydrofurfuryloxy acetic acid, phenoxy acetic acid, cresoxy acetic acid, aryloxy fatty acids alkylated or cycloalkylated in the nucleus, naphthenyloxy acetic acids, abietyloxy acetic acids, benzyloxy acetic acid, tetrahydromenaphthyloxy acetic acid, dioctyloxy acetic acid, α-heptyloxy propionic acid, β-octyloxy propionic acid, γ-octyloxy-isobutyric acid, α-octyloxy capric acid and the like. Furthermore alkoxy fatty acids may be used, which are obtained from secondary alcohols by converting with halogen fatty acids, the alcohols being obtained from the first running acids of the paraffin oxidation with 7 to 9 carbon atoms by ketonizing and subsequent hydrogenizing or such alkoxy fatty acids, which are obtained by reacting alcoholates of the primary alcohols C_7—C_9 with α-halogen fatty acids such as α-butoxy lauric acid, 6-hydroxy-n-hexyloxy acetic acid, methoxy-n-hexyloxy acetic acid and the like. Among these ether carboxylic acids the alkoxy and cycloalkoxy fatty acids are to be preferred.

The water soluble salts of those ether carboxylic acids which may be formed with alkalis, earth alkalis, ammonia or organic bases, distinguish compared with ordinary soaps by their neutrally reacting in aqueous solutions, owing to which fact they exert an excellent skin preserving effect. Furthermore they are more resistant to acids than ordinary soaps. Compared with organic mineral acid derivatives of a soap like character such as fatty alcohol sulfonates and the like, the salts of the ether carboxylic acids have the advantages that they do not cause any corrosion with metallic articles in aqueous solutions. With quaternary ammonium salts also applied in the cosmetics as washing and disinfecting agents, they are well compatible and finally, they have a good disinfecting action.

As water soluble polymerisation products especially polymerised carboxylic acids, their salts and their water soluble derivatives are to be named such as polymerised acryl acid, its homologues or derivatives, further any water soluble derivatives of insoluble polymeric carboxylic acids. Likewise mixed polymerisates containing a carboxylic group may be applied which are obtained by polymerisation of mixtures of substances such as acryl acid, maleic acid and styrol and which become soluble in water by neutralising the carboxylic groups with bases. In the same manner products may be used which are obtained by the sulfonation of polymerisates insoluble in water such as polystyrol. Also polymerisation products of alkylene oxides, vinyl methyl ethers, higher alkyl vinyl ethers and similar substances may be employed, and likewise the condensation products from urea and urea derivatives with aldehydes such as formaldehyde and the condensation products from cyclic amidines such as melamine, 2,4-dihydrazino-quinazoline with aldehydes.

The shaping of the water soluble salts of the ether carboxylic acids with the aforementioned polymerisation or consendation products is advantageously carried out by an addition of a suitable binding agent such as tragacanth, starch, dextrine, paraffin, waxlike stuffs e. g. hardened castor oil, or preferably of the water soluble ethers, ether carboxylic acids or ether sulfonic acids of the cellulose. Moreover any other mineral substances may be added in a finely distributed colloidal form such as kaolin, magnesia, bentonite or other silicious earths.

The manufacture of the different soap preparations is performed in such a manner that the salts of ether carboxylic acids are dissolved in water together with the said polymerisation or condensation products as well as with the binding agents and mineral stuffs, whereupon the mixture is evaporated to the desired consistency

for shaping. The different materials may likewise be mixed by stirring, kneading or rolling. Salts such as soda, sodium bitartrate, etc., soaps, solvents, disinfecting media, oxygen supplying agents, filling stuffs, perfumes and overfatting agents may still be added before shaping. The shaping can be done according to the consistency of the mixtures by pressure, casting, chipping. etc. of the mixtures.

Example 1

40 parts by weight of the sodium salt of the dodecyloxy acetic acid, 32 parts by weight of kaolin, 20 parts by weight of urea formaldehyde condensation product and 8 parts by weight of a 2% aqueous swelling of methyl cellulose are mixed with an addition of perfumes and colour, then piled and pressed into pieces of any desired shape.

Example 2

The concentrated aqueous solution of 41 parts by weight of the sodium of the octyloxy acetic acid, 12,2 parts by weight of the sodium salt of the polyacrylic acid and 0,8 part by weight of tragacanth is stirred together with 46 parts by weight of bentonite. Then the mixture is evaporated till a plastic mass is obtained, which after the piling allows to be shaped into pieces in the usual manner.

Example 3

40 parts by weight of a mixture of the sodium salts of heptyloxy, octyloxy and nonyloxy acetic acid are rolled together with 1 part by weight of a 2,5% aqueous solution of the sodium salt of cellulose glycolic acid, 10 parts by weight of a water soluble urea formaldehyde condensation product, 38 parts by weight of bentonite and 2 parts by weight of a quaternary ammonium compound obtained by reacting dimethylamino acetic acid dodecyl ester and benzyl chloride, then piled and pressed into hand washing pieces which are of a good disinfecting action.

Example 4

38 parts by weight of the sodium salt of a naphthenyloxy acetic acid obtained from naphthenic alcohols, 16 parts by weight of an urea formaldehyde condensation product, 35 parts by weight of kaolin, 8 parts by weight of a 2,5% aqueous solution of the sodium salt of the cellulose glycolic acid and 3 parts by weight of a tanning agent obtained according to the process disclosed in the application Ser. No. 264,126 are mixed and piled etc. The ready mixture allows to be shaped into solid pieces most apt for disinfecting and washing purposes.

WINFRID HENTRICH.
FRANZ GILOY.

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ALIEN PROPERTY CUSTODIAN

PENDULOUSLY MOUNTED COUNTERWEIGHTS AS VIBRATION ELIMINATORS

Otto Specht, Berlin-Spandau, Germany; vested in the Alien Property Custodian

Application filed November 23, 1940

The invention relates to rotating machine elements with pendulously mounted weights subject to the influence of the centrifugal force and serving for the elimination of vibrations, comprising a roller arranged in a raceway provided between the rotating machine element and the weight. Weights supported in this way are in the main used for the elimination of torsional and flexural vibrations in crankshafts of internal combustion engines; the invention, however, relates also to vibration eliminators for general application in mechanical engineering for the purpose of damping torsional and flexural vibrations.

It is already known to employ for the elimination of vibrations pendulously mounted weights provided with raceways in the rotating part and in the weight, between which a roller is arranged. By differently dimensioning the raceway radii, it is possible to modify the pendulum length and thus the tuning of the pendulum motion in order to realize the elimination of certain vibration orders. It has been stated that with the usual forms of construction the roller arranged between the two raceways is under the action of the centrifugal force subject to very high flexural and compression stresses so that, particularly for tuning to low vibration orders of the first or second order, because of the necessary roller diameter, the raceways must be so remarkably enlargened that the external form of construction is confined to certain limits.

Further it is necessary in the case of an outlay for low vibration orders to provide with regard to the strong exciting impulses occurring under these circumstances for a larger mass of the counterweight.

This, too, will have an unfavourable influence upon the diameter of the roller, which of course should be further enlargened, so that consequently also an enlargement of the raceways would be necessary. From reasons of strength it cannot be realized to effect tuning to low vibration orders with the forms of construction hitherto known.

These disadvantages are avoided according to the invention by the fact that the roller is occupying almost with its full length as well the rotating raceway as the raceway on the weight, i. e. it is bearing on its entire length. By this arrangement it is possible to modify the stressing of the surfaces in contact with each other, in addition to the influence originating in the lubricating conditions in dependence upon the pendulum length, also by the specific pressure of the roller. Now the roller is no longer subject to flexural stresses and edge pressures, but only to compression stresses i. e. the arrangement according to the invention brings about a diminution of the stressing modes from two to only one.

In this way it is possible to reduce the diameter of the roller considerably so that consequently also the dimensions of the raceways can be reduced. This brings about a diminution in the overall size and for the first time permitted to design vibration eliminators of large masses which can be tuned to vibration orders of the first or second order.

The following example is given for additionally explaining the invention. With known constructions it is not possible to provide a roller diameter being considerably larger than abt. 1⅛–1¼ in., as for obtaining the necessary pendulum length the roller raceways must have a radius, for which practically already with the above diameter there is no possibility of accommodation in the swinging centrifugal weight. This was the reason of designing new forms of roller raceways. The said diameter generally corresponds to the tuning to the vibration order 4,5 and is closely at the limit of admissible strength, so that already disturbing flexural and compression stresses are occurring. An enlargement of the roller from reasons of strength and consequently an enlargement of the raceways and in addition a further enlargement for the purpose of tuning to a lower vibration order, which besides that requires the possibility of a larger mass of the centrifugal weight, is already no more possible from constructional reasons.

The details of the invention are to be seen from the examples of construction in the drawings representing the mounting of a centrifugal weight, with the essential elements of the invention for damping flexural or torsional vibrations in the crankshaft of an internal combustion engine. In the drawings

Fig. 1 is a side elevation of a pendulum for the elimination of torsional vibrations.

Fig. 2 a section taken on line II—II of Fig. 1.

Fig. 3 a plan view partly in section taken on line III—III of Fig. 1.

Fig. 4 a side elevation of a pendulum for the elimination of flexural vibrations.

Fig. 5 a section taken on line V—V of Fig. 4.

Fig. 6 a plan view partly in section taken on line VI—VI of Fig. 4.

To the crank cheek 1 of the crankshaft (not represented in the drawings) of an internal combustion engine two laterally embracing plates 2

and 3 are secured by means of screws 4 or the like. Instead of providing the said plates 2 or 3 it is also possible to enlarge the crank cheek 1 at its end and to provide it with lateral extensions. The plates and the enlargement must be so dimensioned that they approximately correspond to the thickness of the centrifugal weight. The freely projecting ends 5, 6 of the plates 2 or of the enlargement are the raceways 7 provided in the rotating machine element. The centrifugal weight 9 is preferably made divided normally to the crank circle at 8 and has a recess 10 which is greatly occupied by the enlargement or by the plates 2 of the crank cheek 1, taking regard, however, to the pendulum swing. In the upper part 9' of the centrifugal weight are arranged the raceways 11 which likewise extend over the entire width of the weight as to be seen particularly in Fig. 2. The crank cheek 1 projects through the recess 12 of the upper part 9' of the centrifugal weight. The two halves 9 and 9' of the centrifugal weight are secured together by bolted joints 13 or the like. Between the raceways 7 and 11 are arranged the rollers 14, which with their full length occupy the full width of the raceways 7 and 11 and are, as particularly to be seen in Fig. 2, clearly stressed only just in compression and not subject to any flexural stresses or edge pressure. It will easily be understood that with the help of such an arrangement the roller is capable of influencing the ratio of the raceway radii in so far, that now in spite of an increase in the mass of the centrifugal weight, if there is the necessity of tuning to low vibration orders, no increasing of the overall size will be necessary. Further it is possible to provide different roller raceway radii for tuning, particularly with regard to the strength of the rollers 14.

The rollers 14 are protected against axial displacement by the guide plates 16 which are secured by bolts to the projections 5 and 6.

The suspension of a centrifugal weight represented in Fig. 4 is realised on the same principles of Fig. 1 and 3, only it is the matter of an arrangement for damping flexural vibrations in this case. The arrangement comprises a centrifugal weight 9, which, as represented in Fig. 1, may be subdivided and provided with a recess 10, said recess being almost fully occupied by an enlargement of the crank cheek 1, in which case said enlargement may consist of two plates 2 and 3 screwed to the crank cheek 1.

The ends 5 and 6 of the plates bear the raceways 17 which in this case do not run in the direction of the crank axle, but normally thereto, as shown particularly in Fig. 5 in section. The raceways 19 can be worked into the upper part of the centrifugal weight 9 or being represented by subsequently inserted fittings 18. Between the raceways 17 and 19 are arranged the rollers 20 which like in the example represented in Fig. 1 occupy simultaneously as well the rotating raceway as that of the weight, so that they can be stressed only in one direction i. e. in compression.

OTTO SPECHT.

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BY A. P. C.

O. SPECHT
PENDULOUSLY MOUNTED COUNTERWEIGHTS
AS VIBRATION ELIMINATORS
Filed Nov. 23, 1940

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2 Sheets-Sheet 1

Fig.2

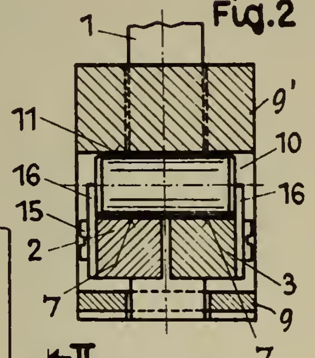

Fig.1

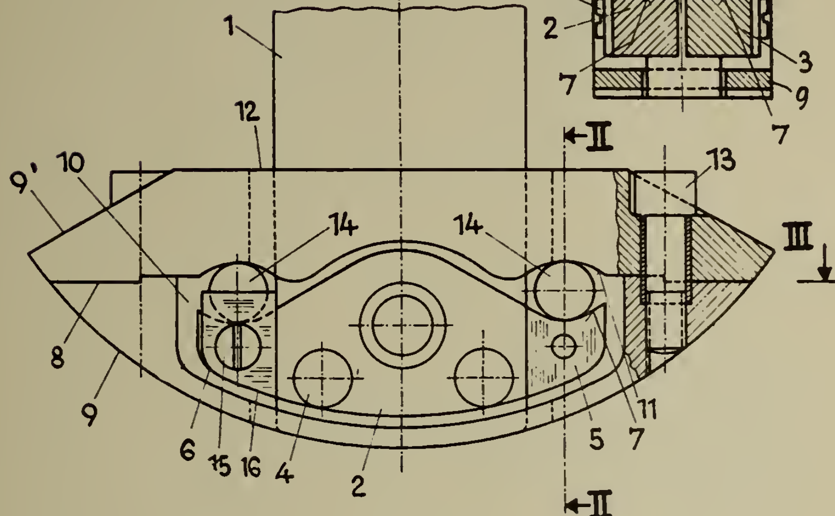

Fig.3

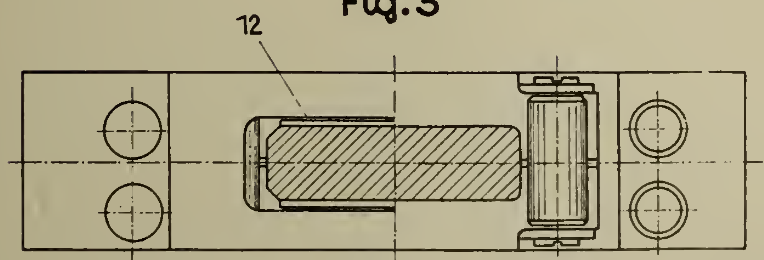

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Fig. 4

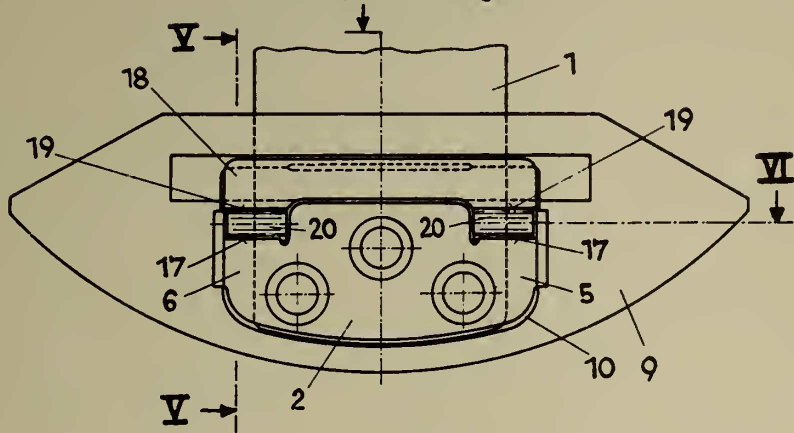


Fig. 6

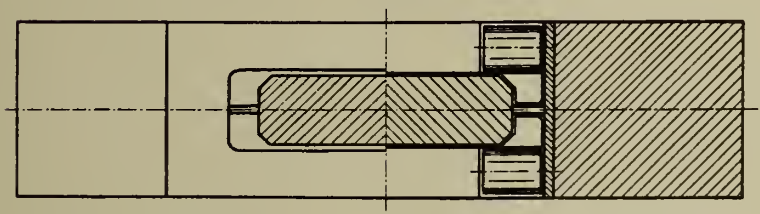
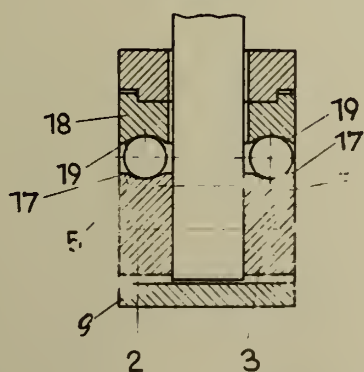


Fig. 5



Inventor:

Published June 1, 1943

Serial No. 367,262

ALIEN PROPERTY CUSTODIAN

PROCESS OF PREPARING LUSTROUS COATINGS AND THE MATERIALS THUS PRODUCED

Walter Pense and Werner Asch, Frankfurt am Main, Philipp May, Ludwigshafen am Rhein, and Hermann Stärk, Bad Soden (Taunus), Germany; vested in the Alien Property Custodian

No Drawing. Application filed November 26, 1940

The present invention relates to a process of preparing lustrous coatings and the materials thus produced and it especially relates to lustrous coatings on materials of fibrous structure selected from the group consisting of leather, artificial leather, oilcloth, vulcanized fiber and paper board.

Various processes are already known for producing coatings on leather and other fibrous materials with synthetic resins, for instance resins obtained by polymerization processes. It is, however, in general not possible to produce lustrous coatings by glazing since the products used are thermoplastic and soften during the glazing operation.

Now we have found that lustrous coatings may be produced on fibrous materials, such as leather, artificial leather, oilcloth, paper board or vulcanized fiber by applying to said materials a solution of a salt of the interpolymerizate from unsaturated carboxylic acids and vinyl compounds and subsequently glazing the impregnated materials. According to the present invention there are, for instance suitable for the process herein described the watersoluble alkali metal salts, ammonium salts and amino salts of interpolymerizates from crotonic acid, acrylic acid, alphamethacrylic acid, tetrahydrophthalic acid, maleic acid and vinyl ester, such as vinyl acetate, vinyl propionate, or vinyl ethers such as vinyl methyl ether, vinyl butyl ether, or other vinyl compound, such as styrene.

The solutions of salts of the interpolymerization products have a neutral reaction and are resistant to alkali. By a suitable selection of the components and the polymerization process there may be prepared interpolymerizates of a different viscosity. The resistance to water and fastness to rubbing of the coatings produced with the resins named herein may be improved by aftertreating the materials with formaldehyde or mixtures of formaldehyde and metal salts, such as salts of chromic acid or aluminium salts. The coating material may be applied in several layers. Furthermore it is possible to apply the coating destined for producing the lustre on other coatings, for instance coatings consisting of albuminous substances, such as albumin and casein. Pigments may likewise be admixed to the coating materials, but in the top coating the addition of pigments is suitably avoided.

The solutions of salts of the interpolymerizates from unsaturated carboxylic acids and vinyl compounds may be used alone or in combination with other binding and finishing agents; there may, for instance be named water-soluble or alkali-soluble albuminous substances, water-soluble cellulose compounds, natural or artifical resins.

The softness and suppleness of the coatings may be varied by the addition of water-soluble softening agents, such as glycerine, poly-glycerine, or of emulsions of fats, oils and waxes. Owing to the dispersing action of the interpolymerizates it is possible to add waxes, natural resins, fats and oils to the finishing material, this having not always been possible when the albuminous substances were used.

The following examples serve to illustrate the invention, but they are not intended to limit it thereto:

1. A lustre may be produced on leather by operating for instance as follows: A water-soluble coating-color to be applied on leather is first prepared in the following manner:

	Grams
A solution of 6 per cent strength of the sodium salt of the free acid from the interpolymerization product prepared from styrene and maleic anhydride	80
A solution of 20 per cent strength of the ammonium salt of the free acid from the interpolymerization product obtained from vinyl butyl ether and maleic anhydride	25
Iron oxide	70
Glycerin	10
Neat's-foot oil	2
The dyestuff No. 293 (Schultz, Farbstofftabellen 7th edition, 1931)	5

The mixture is ground with addition of water to form a uniform paste and before use it is diluted with water to 1500 grams. The coating-color thus obtained is applied by means of a brush or a spraying device to chrome-tanned calf which is prepared in known manner for finishing. If required several coatings may be applied with the same mixture until the leather is sufficiently covered; before each application of the mixture the leather is allowed to dry. For producing a lustre the following dressing is then applied to the leather:

	Grams
A solution of 20 per cent strength of the ammonium salt of the free acid from the interpolymerization product prepared from vinyl butyl ether and maleic anhydride	50
A solution of 6 per cent strength of the sodium salt of the free acid from the interpolymerization product obtained from styrene and maleic anhydride	16
Glycerine	16
Water	774

After the dressing applied has been allowed to dry the following solution is applied to the material with a spraying device in order to improve the fastness to water:

	Grams
Chromic chloride (crystallized)	5
Formaldehyde of 30 per cent strength	200
Water	795

The leather is then well dried, glazed and ironed.

The leather thus finished is of a very uniform color, has a good lustre and is suitable as boot uppers.

The following kinds of leather may be dressed with the coating-color above described:

Box-calf, box-sides, glazed kid, colt kid, chevrette, water-proof, garment-leather, glove leather such as chamois leather, mocha, alum velour, nappa leather, velvet and nubuck leather; furthermore all vegetable leathers such as sole leather, harness leather, vachettes and all kinds of fancy leathers and leathers used for hand bags and consisting of animal and reptile leathers, such as fish-, snake-, lizard- or frog skins and the like. These leathers may be finished either on the grain side, it being immaterial whether the grain is present or has been removed, or on the flesh side. It is also possible to coat with the coating-color finished articles made of dyed or non-dyed leathers such as boots, handbags, porte-folios, bags or the like; the appearance of these articles may be improved by such a treatment.

2. A lustrous coating for artificial leather prepared from comminuted leather and synthetic resins is prepared as follows:

	Grams
A solution of 25 per cent strength of the ethyl amine salt of the free acid from the interpolymerization product obtained from vinyl methyl ether and maleic anhydride	100
The dyestuff No. 1236 (Schultz, Farbstofftabellen, 7th edition, 1931)	10
Glycerine	10
Neat's-foot oil	2

are ground, while adding water, until a uniform paste is produced; 25 grams of an emulsion of 40 per cent strength of polyacrylic acid ethyl ester in water are then added and the whole is made up with water to 750 grams.

The mixture is applied in the same manner as it is described in Example 1.

The following mixture is used as lustrous finish:

75 grams of a solution of 25 per cent strength of the ammonium salt of the free acid from the interpolymerization product obtained from vinyl-methyl-ether and maleic anhydride and
8 grams of glycerin, diluted with water to

1000 grams.

For improving the fastness to water the leather is finally hardened with the following solution:

	Grams
Aluminium sulfate	10
Formaldehyde of 30 per cent strength	200
Water	790

The artificial leather thus treated is finally glazed.

3. A coating consisting of casein, pigments and Turkey red oil is applied in the usual manner on vulcanized fiber. For producing a gloss and improving the fastness to rubbing the vulcanized fiber is sprayed with the following finishing:

	Grams
A solution of 10 per cent strength of the ammonium salt of the free acid from the interpolymerization product prepared from vinyl acetate and maleic anhydride	200
Polyglycerin	8
Water	792

After the finishing has been applied the material is hardened with a formaldehyde solution of 10 per cent strength, dried and ironed or calendered. The material thus treated shows a high gloss.

4. A lustrous coating on paper board is produced as follows: A color-coating for paper board is first composed in the following manner: There are fused

3 grams of colophony and the melt obtained is stirred into
50 grams of a solution of 10 per cent strength of the ammonium salt of the free acid from the interpolymerization product obtained from vinyl acetate and crotonic acid.
50 grams of methyl cellulose solution of 5 per cent strength,
10 grams of the dyestuff No. 86 (Schultz Farbstofftabellen, 7th edition, 1931) and
10 grams of glycerine are added to the mixture and

the whole is ground with the addition of water until a uniform paste is obtained. The mixture is adjusted to 500 grams by adding water and applied to the paper board with a dyeing machine or a spraying device. In order to produce a thick coating the mixture is applied several times and between each application the material must be dried.

As a glazing finish one or several coatings of the following composition are applied to the material:

5 grams of colophony are fused and the melt obtained is stirred into
100 grams of a solution of 10 per cent strength of the ammonium salt of the free acid from the interpolymerization product prepared from vinyl acetate and crotonic acid and the whole is then diluted with water to

500 grams

The finish is after-treated as described in Example 1 with chromic chloride and formaldehyde for improving the fastness to water. After drying the paper board is calendered and a high gloss is produced thereon.

5. A finish for leather is prepared as follows: 25 grams of a solution of 10 per cent strength of the ammonium salt of the free acid from the interpolymerizate from vinyl acetate and acrylic acid are diluted with water to 1 liter. The finish is applied to chrome-tanned goat-skin by means of a soft brush or a spraying device; the goat skin has previously been dyed fat-liquored, dried, and staked in known manner.

After drying the finish may very readily be glazed and a satisfactory finishing effect of a high gloss is obtained.

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ALIEN PROPERTY CUSTODIAN

DEVICE FOR MAKING SCREW THREADS

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Application filed November 28, 1940

This invention relates to a device for making screw threads.

The manufacture of good screw threads in tough steels of high quality presents great difficulties even at the present time. The bottom of the thread grooves is often torn or damaged during the cutting of the screw threads and then the lack of smoothness of the thread surface subjects the threads to an increased danger of corrosion.

Prior art devices for the rolling of screw threads operate satisfactorily only when the material which is to be worked on is comparatively soft and does not exceed a certain degree of hardness. Then, a cylindrical blank may be subjected to a rolling operation for the purpose of cutting screw threads therein and a preliminary cutting of the blank prior to the rolling operation is not necessary. However, cylindrical blanks consisting of high quality steels of great hardness cannot be subjected to a rolling operation for the purpose of making screw threads therein, without a preliminary cutting or milling of the screw threads.

The rolling of screw threads is often carried out by a plurality of rollers mounted in a casing. These known devices do not operate with that degree of precision which is required from tools subjecting threads cut in materials of an especially high quality by a preliminary operation, to final rolling and calibrating operations.

An object of the present invention is the provision of a tool which is so constructed that its rollers used for the rolling of screw threads, are guided therein with the greatest amount of precision.

Another object is the provision of a thread rolling tool wherein the position of the rollers can be so adjusted that the treating channel formed by the rollers for the workpiece can be conical as well as cylindrical.

A further object is the provision of a single thread rolling tool which can be used for making threads of different diameters.

A still further object is the provision of a thread rolling tool having roller-supporting axes, the angles of inclination of which are made adjustable, thereby facilitating the introduction of the workpiece between the rollers and providing for an adjustment of the wear upon the ribs of the rollers.

An additional object of the present invention is the provision of a tool, the rollers of which are yieldably supported in axial and radial directions, thereby facilitating the insertion of the front ribs of the rollers into the first turn of the previously cut screw threads of the workpiece.

Yet another object of the present invention is the provision of a thread rolling tool, the rollers of which may be uniformly adjusted in the radial direction.

Another object is the provision of a thread rolling tool, the various parts of which are so constructed that the introduction of the first turn of a screw thread in the workpiece over the first ribs of the rollers is considerably facilitated and the danger of damage to the screw threads or to the ribs of the rollers resulting from an incorrect insertion of the workpiece, is effectively avoided.

A further object is the provision of a thread treating tool which can operate effectively even in case the return movement of the various workpiece-treating elements does not start at the correct instant.

A still further object of the present invention is the provision of a tool for the final treatment of previously cut screw threads, which will make the bottom and side surfaces of the threads of exceptional smoothness and of a permanent high caliber.

Yet another object of the present invention is the provision of a thread-making tool which can be utilized most economically for the mass production of screw threads and by means of which it is possible to provide in very large quantities workpieces having screw threads which are all uniform and conform to the standard requirements.

An additional object of the present invention is the provision of a single tool which may be used for finishing screw threads which have been previously cut in hard and tough steels, and which can be also utilized for the making of screw threads from cylindrical blanks in a single operation, provided that such blanks consist of a material which is not too hard.

Other objects of the present invention will become apparent in the course of the following specification.

In accomplishing the objects of the present invention, it was found desirable to provide rollers used for the treatment of the screw threads, which are mounted adjustably in the radial direction within a frame work in such manner that their positions can be influenced by adjusting means connected with the framework so as to cause the axes of the rollers to extend not only parallel to each other, but also at the same angle of inclination to each other, whereby the treating

channel for the workpiece which is formed by the rollers, can be made either cylindrical or conical.

In accordance with a preferred embodiment of the inventive idea, the rollers are mounted upon a plurality of discs which are yieldable in the radial direction and which are supported in a framework with the aid of wedge-like rings, a separate ring being provided for each disc.

Nuts or similar elements screwed upon the frame work are used for adjusting the wedge-like rings and, consequently, the mounting of the rollers.

An advantage of this construction is that it makes it possible to adjust the positions of all the rollers uniformly in the radial direction without it being necessary to shift each roller separately since such separate shifting can easily result in an incorrect or insufficiently exact adjustment.

Furthermore, in accordance with a preferred embodiment of the inventive idea, the round framework of the tool is yieldably mounted by means of pressure springs in relation to the chucking piece of the tool.

Due to this yieldable mounting, the insertion of the first turn of the previously cut screw threads over the first ribs of the rollers is considerably facilitated and any danger that the threads or ribs may be damaged by incorrect insertion is effectively avoided.

According to the preferred embodiment of the inventive idea, a coupling is provided between the casing receiving the rollers and the chuck rod of the tool, this coupling interrupting the operation as soon as the previously cut screw threads are completely inserted into the tool.

The provision of this coupling has the advantage that the tool operates properly even then when the machine begins its return movement not at that moment in which the last turn of the previously cut thread is moved between the rollers. Consequently, the coupling eliminates the danger that the workpiece or the tool may be damaged or destroyed by the late switching off of the rotary movement.

The invention will appear more clearly from the following detailed description, when taken in connection with the accompanying drawings, showing, by way of example, a preferred embodiment of the inventive idea.

In the drawing:

Figure 1 shows in section a tool constructed in accordance with the principles of the present invention, the section being taken along the line I—I of Figure 2.

Figure 2 is a section along the line II—II of Figure 1.

The tool shown in the drawing includes rollers 1, 2 and 3, the outer surfaces of which are provided with ribs used for the cutting or polishing of screw threads. The rollers 1, 2 and 3 are rotatably mounted in discs 4 and 5 in such manner that the rollers do not touch each other (Fig. 2).

Each of the discs 4 and 5 is provided with rarial slots 6, 7 and 8 extending between the roller mountings. The slots 6 and 7 do not extend to the periphery of the disc, while the slot 8 which is in communication with the slots 6 and 7, extends along the entire radius of the disc. Due to this arrangement, each of the discs constitutes a resilient support for the rollers.

The disc 4 is in contact with a wedge-shaped ring 9, while a similar ring 10 is in contact with a disc 5. The discs 4 and 5 are mounted in a frame work 11 which is closed on both sides by threaded caps 12 and 13.

The caps 12 and 13 carry screws 14 and 15, respectively, which press against the frame work 11 and hold the caps 12 and 13 in the desired position upon the framework.

The outer surfaces of the wedge-shaped rings 9 and 10 are in engagement with the inner surfaces of the threaded caps 12 and 13, respectively. By turning the caps 12 and 13 after the screws 14 and 15 have been unscrewed, it is possible to shift the rings 9 and 10 and thereby change their position in relaiton to the discs 4 and 5 and the framework 11.

Depending upon the direction of the movement of the wedge-shaped rings 9 and 10, the discs 4 and 5 are either compressed or spread out, since the provision of the slots 6, 7 and 8 makes these discs resilient, and thus, the relative positions of the rollers 1, 2 and 3 carried by these discs are changed.

The cover 13 is connected or integral with a support 16 for the pressure springs 17, said springs being situated in recesses formed in the support 16. The outer ends of the springs 17 engage a plate 18 which is firmly connected with a coupling element 20.

The cover 13 is also connected with an inner shaft 19 which belongs to the chucking portion of the tool.

The cap screw 21 which is screwed upon the support 16, is used to provide a resilient connection between the plate 18 with the coupling element 20 on the one hand, and the threaded cover 13 with the shaft 19 as well as all the parts of the roller support, on the other hand.

A sleeve 22 is used for the chucking of the tool in a tool machine (not shown). The sleeve 22 encloses the shaft 19 and is separated from the shaft by a spring 23. The sleeve 22 is firmly connected with the second coupling element 24 which cooperates with the coupling element 20 and which at the same time serves as a support for the coil spring 23.

The second support for the spring 23 is constituted by a ring 25 which is mounted upon an end of the shaft 19 and which is prevented from turning relatively to this shaft by means of a pin.

A nut 26 is screwed into an end of the sleeve 22 and is used to maintain the sleeve 22 upon the shaft 19.

In the position shown in Figure 1, the coupling 20, 24 which is situated between the sleeve 22 and the remaining parts of the device, is shown in the engaged position namely, the coupling elements 20 and 24 are in engagement with each other, so that these is a rigid connection between the sleeve 22 and the casing carrying the rollers 1, 2 and 3 and constituted by the framework 11 and the caps 12 and 13.

If the casing is pulled away from the sleeve 22, against the action of the compression spring 23, the shaft 19 will slide relatively to the sleeve 22; the coupling elements 20, 24 will move away from each other and will be disengaged finally. As soon as the coupling 20, 24 is disengaged, the roller casing 11 to 13 will be rotatable relatively to the sleeve 22.

If, on the other hand, the casing 11 to 13 is pressed in the opposite direction toward the sleeve 22, then after overcoming the pressure of the springs 17 it will bear elastically toward the sleeve 22.

Consequently, the casing 11 to 13 carrying the rollers 1, 2 and 3, is resiliently supported in both directions as far as its longitudinal axis is concerned in relation to the sleeve 22, as soon as a

certain force has been overcome. The casing can be rotated in relation to the sleeve **22** when the coupling elements **20** and **24** are brought out of engagement.

In operation, the sleeve **22** of the tool is held firmly within the revolving head of a lathe, the tool support of an automatic or the support of a turning machine (not shown).

A workpiece **27** (Fig. 1) consisting for instance, of a screw, the threads of which have been previously cut in a preliminary operation, is firmly held in a suitable support of the machine.

During the operation the tool receives a feed movement in the direction of an arrow *a*, the extent of this movement corresponding to the length and the pitch of the screw threads which are to be finally treated by the tool. At the same time, the workpiece **27** is rotated in the direction of the arrow *b*.

The casing **11** to **13** containing the rollers is moved slowly forward while the workpiece **27** is rotated. As soon as they meet, the casing will first yield slightly due to the provision of the springs **17**, before the rollers **1**, **2** and **3** engage the workpiece and complete the treatment of the first turn of the screw threads.

After the screw threads of the workpiece have been rolled to a predetermined length, the tool is moved in the opposite direction and, at the same time, the workpiece is caused to rotate in the opposite direction. Then the workpiece **27** is withdrawn from its position between the rollers **1**, **2** and **3**.

During the rolling process, a liquid which serves for the cooling lubrication of the tool and workpiece, flows through the channels **28** in the framework **11**.

The coupling **20**, **24** situated between the sleeve **22** and the casing **11** to **13** is used to secure the device against breakage or damage in case the switching device (not shown) causing the return movement of the workpiece fails to operate properly or in case of lack of attention on the part of the operator.

It may happen, for instance, that at the time when the screw threads have been rolled to a predetermined length, the return movement of the workpiece does not start on time, either due to lack of attention on the part of the operator, or through breakage of a part of the automatic lathe. In that case the tool carrier of the machine which holds the casing **11** to **13**, remains immovable at the end of the previously set feed movement. However, the workpiece **27** with its previously cut screw threads would continue its rotation and would be screwed further and further into the tool casing, attempting to draw it away from the tool carrier of the machine and toward the workpiece holder.

In that case the safety coupling **20**, **24** will prevent the damage. The force will be transmitted to the springs **23**, and the bolt **19** will slide in the sleeve **22**, so that the coupling elements **20**, **24** will move away from each other and finally, will be brought out of engagement. Since the tool casing **11** to **13** is now in firm engagement with the workpiece by means of the rollers **1**, **2** and **3** which press against the screw threads of the workpiece, the casing will begin to rotate along with the workpiece **27** as soon as the coupling **20**, **24** is disengaged. This rotation continues until the workpiece begins its return movement and is screwed out of its position between the rollers **1**, **2** and **3**.

As already stated, the position of the rollers **1**, **2** and **3** relatively to each other is adjusted by loosening the screws **14** and **15** and turning the screw caps **12** and **13**. This changes the position of the wedge-like rings **9** and **10** in relation to the discs **4** and **5** and to the framework **11**. Since the discs **4** and **5** are resilient due to the provision of the slots **6**, **7** and **8**, the three rollers **1**, **2** and **3** are moved closer to each other or away from each other by a change in the position of the rings **9** and **10**.

In order to enable the operator to determine conveniently the position of the rollers **1**, **2** and **3**, the outer periphery of the framework **11** is provided with a scale **29** and the screw caps **12** and **13** carry arrows or pointers **30**. The positions of the arrows **30** in relation to the scale **29** and in relation to each other make it possible to determine the position of the rollers **1**, **2** and **3**. By these means it is also possible to cause the rollers to extend conically, should this appear to be advisable when treating certain workpieces.

It is apparent that the specific illustrations shown above have been given by way of illustration and not by way of limitation and that the structures above described are subject to wide variation and modification, without departing from the scope or intent of the present invention; all of such variations and modifications are to be included within the scope of the present invention.

ALBERT SCHÜTTE.

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BY A. P. C.

A. SCHÜTTE
DEVICE FOR MAKING SCREW THREADS
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Fig.1

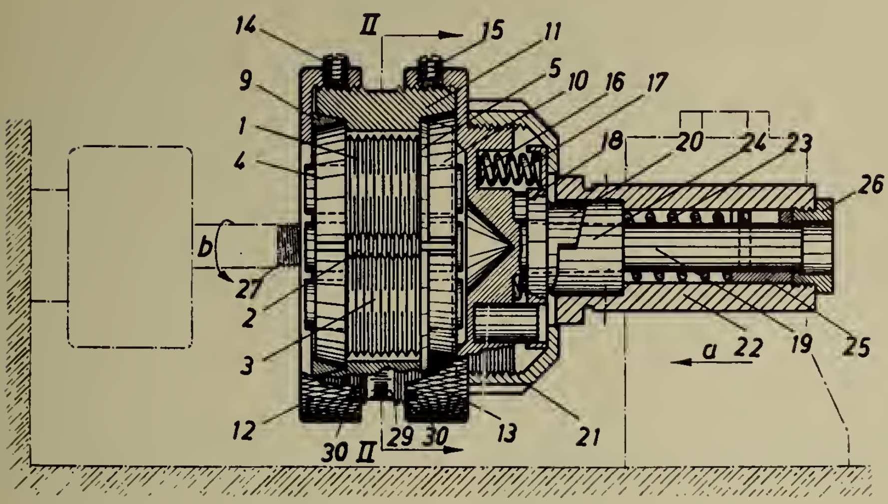
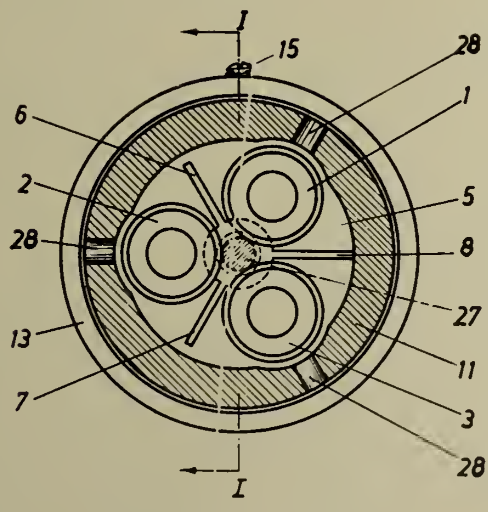


Fig.2



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ALIEN PROPERTY CUSTODIAN

METHOD FOR THE PRODUCTION OF CORROSION-PROOF AND HEAT-PROOF CHROMIUM COATINGS

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No Drawing. Application filed December 11, 1940

In order to render corrosion- and heat-proof the surface of articles of iron and steel, the surface has already been enriched in chromium by thermic diffusion. This is effected according to known methods, for instance in that the pieces at temperatures from 900–1100° C are exposed for several hours to a gaseous chromium-chloride compound, the chromium constituent of which replacing the iron in the surface layer of the treated articles. In this manner iron-chromium alloys with up to 35% of chromium are produced in the surface. Corrosion- and heat-proof surfaces on articles consisting of iron or steel can also be produced by applying on them galvanic chromium coatings. Such chromium coatings, however, do not adhere very solidly on the base metal and they burst off already at comparatively low mechanical stressing of the work piece. It has already been proposed to obviate these inconveniences by heating the galvanically covered pieces in neutral atmosphere to higher temperature and by diffusing the metals the one into the other. As also this method was not yet absolutely satisfactory, that is because it did not result in a sufficient adhering of the chromium coatings produced by galvanic method on the base metal, the proposal has been made in the German Patent No. 563,882, to galvanically coat with chromium the base metal after applying to them a layer of nickel or cobalt as intermediate layer, and to then diffuse the metals the one into the other by heating in neutral atmosphere to temperatures at which a melting of the intermediate layer does not occur.

Whereas, therefore, up to the present the inconvenience inherent to the corrosion- and heat-proof chromium coatings produced by galvanic method with subsequent thermic diffusion were looked for in first instance in the constitution of the protecting layers themselves and consequently the proposals for avoiding them were directed exclusively to an influencing of the layers themselves, it has now been found, that for the adhering capability, that is the connection of the chromium coatings produced by galvanic method and subsequently treated thermically and their quality the quality of the base metal is chiefly decisive on which the layers have to be applied. Experiments have shown, that the galvanically applied chromium at the subsequent thermic treatment diffuses much easier and deeper into the surface of the articles consisting of iron or steel, if these articles do not consist of unalloyed iron or steel, but of iron-carbon alloys, which contain as alloying elements also titanium, vanadium, tantalum, niobium, chromium, molybdenum, manganese, aluminium and silicium, these substances singly or several of them. It is material, that the effect of these elements with regard to favouring the chromium-diffusion is realised not only on higher carburised iron or steel but also on iron-carbon alloys with very low carbon contents. Whether then the effect, for instance of the titanium, tantalum, niobium and vanadium is due to the premature tying off of the α range, or as regards the diffusion still other effects play a role, has not yet been cleared up at present. In iron- and steel qualities with higher carbon content the above mentioned alloying elements avoided evidently a wandering of the carbon in the cross section of the pieces to be coated, which occurs even then, if the carbon content in percents is very low, for instance is below 0.1%, but the wall thickness of the articles to be treated is comparatively thick, for instance 10 mm thick. At such a wandering of carbon surface layers rich in carbon result which render it difficult for the chromium to penetrate or even prevent the penetration of chromium.

For the galvanic chroming with subsequent thermic diffusion the following iron-carbon alloys have to be used according to the invention:

		Per cent
(1)	Carbon	0.02–0.4
	Titanium, niobium or tantalum	Up to 3
(2)	Carbon	0.02–0.4
	Manganese	2 –6
(3)	Carbon	0.02–0.4
	Aluminium	Up to 2

Iron-carbon alloys with 0.02–0.4% carbon have also proved to be very useful, the alloys containing at the same time titanium and molybdenum, the content in titanium corresponding to 1 to 4 times, preferably twice the content of carbon, and the content of molybdenum amounting to 0.2–3% preferably 0.5 to 1.5%. Good results were further obtained with alloys having 0.02 to 0.4% carbon, 2 to 3% chromium and 0.5 to 2% vanadium. In the remainder of all the alloys are present iron and the usual companions of the iron, and it has further shown that a phosphorus content higher than the usual amount up to 0.3% influences diffusion in a favourable sense. The same favourable influence is exerted by a silicon content of up to 2%.

The production of the articles with the galvanic chromium coatings from the alloys as stated is not only favourable when the chromium coating is applied directly on to the base metal, but also when intermediated layers are employed, for instance such of nickel or cobalt and the whole is then submitted to a thermic subsequent treatment.

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ALIEN PROPERTY CUSTODIAN

MAGNESIUM BASE ALLOY

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No Drawing. Application filed December 12, 1940

This invention relates to magnesium base alloys and is a continuation-in-part of our application Serial No. 236,552, filed October 22, 1938, for Magnesium Base Alloys.

The development of high percentage magnesium base alloys for castings, was primarily determined by the circumstance that the only possible method of obtaining a cast crystalline structure of technically useful strength properties, from magnesium, was by the incorporation therewith of alloying components having hardening properties. Up to the present, aluminium and zinc have been almost exclusively employed for this purpose. These metals, when employed in the usual proportions of 4 to 10 per cent of aluminium, on occasion together with up to 3 per cent of zinc, exert a hardening and grain-size reducing action on the magnesium, which in itself is soft and solidifies with a coarse radial crystalline structure. According to their special composition and the method of casting (sand, permanent mould, or injection) employed, these known magnesium base casting alloys have, in the as-cast condition, a tensile strength of from 16 to 22 kgs. per sq. mm., with an elongation of 3 to 12 per cent, a yield point of 8 to 16 kgs. per sq. mm. and a notched-bar impact strength of 0.5 mkgs. per sq. cm. ("Werkstoffhandbuch Nichteisenmetalle", 1936, Sheet K_3).

The tendency of these known magnesium base alloys to form so-called "micro-shrinkage" cracks during solidification must, however, be regarded as a defect. These micro-shrinkage cracks not only render the castings permeable, to some extent, to liquids or gases, but, also, in certain circumstances, considerably impair, by the "notch" effect which said cracks produce, the good mechanical properties attainable by castings of sound crystalline structure. This tendency is especially marked in highly stressed portions of the castings which have thus to be correspondingly thickened. The tendency of the known casting alloys to form such micro-shrinkage cracks appears to be connected with their relatively high content of alloying components, the addition of which in appreciable amounts causes a widening of the solidification interval, i. e. the temperature range between the points of incipient and completed solidification, respectively, as compared with pure or only slightly alloyed magnesium. Attempts to counteract the formation of these micro-shrinkage cracks have hitherto been confined to the extensive use of chill plates and other measures for rapidly cooling the areas where the structure is endangered. Such measures are, however, expensive and also frequently difficult to control in practice.

Bearing in mind the conditions, viz. fineness of grain and narrow solidification interval, which are the main causes for the formation of cast structures of high strength and free from micro-shrinkage cracks, systematic experiments were conducted for the purpose of finding an alloying component or components which would produce a powerful grain-size reducing effect on magnesium, even when employed in such small proportions as are insufficient to cause any appreciable widening of the solidification interval.

As a result of these experiments it was found that zirconium is a metal which fulfills the foregoing requirements, in that even when alloyed with magnesium in proportions of about 0.05 to 2.0 per cent it reduces the grain-size to a far greater extent than the hitherto customary far greater proportions of aluminium and zinc. Moreover, when adding zirconium to the magnesium in the foregoing proportions, the temperature of incipient solidification of the resulting alloys still practically coincides with the temperature at which the resulting alloys become totally solidified so that such alloys solidify without any appreciable formation of micro-shrinkage cracks. The grain-size reducing action of zirconium on pure magnesium (tensile strength in the as-cast condition 9 to 13 kgs. per sq. mm., elongation 5 to 6 per cent) is so powerful that an addition of 0.5 per cent of zirconium imparts to the resulting alloy a tensile strength of 18.5 kgs. per sq. mm. and a yield point of 7 kgs. per sq. mm., which values are nearly equal to those of the casting alloys hitherto in use. Moreover, the elongation is increased to 21.0 per cent and the notched-bar impact strength to 1.5 mkgs. per sq. cm., these values being thus considerably higher than the corresponding values exhibited by the usual casting alloys.

These values exhibited by the binary magnesium-zirconium alloys can be still further improved by the addition of other alloying components. It has, however, transpired that by no means all the components adapted to alloy with magnesium are suitable for this purpose but that, on the contrary, the presence of various of such alloying components more or less prevents the zirconium from exercising its favourable grain refining effect. Thus it has been found that only such alloying components are permissible as are incapable of combining with the zirconium dissolved in the molten magnesium to form high melting compounds which separate out or otherwise physically combine therewith to form components which settle out. In this respect, for example, the metals thallium, bismuth, and lead are suitable alloying components. Other metals, however, for example, aluminium, silicon, tin, cobalt, nickel, antimony, and manganese, which appear to form with zirconium segregating intermetallic high melting compounds, when present in molten magnesium jointly with zirconium, are unsuitable. Thus, the alloy may contain in addition to magnesium and its 0.05 to 2.0 per cent zirconium component between about 0.1 and about 24 per cent of thallium, or between about 0.1 and about 15 per cent of bismuth, or between about 0.1 and about 20 per cent of lead or up to

about 30% of two or all of the aforesaid metals jointly, each within the aforesaid limits.

In addition to magnesium and the aforesaid alloying components, viz. zirconium, thallium, and/or bismuth, and/or lead, the alloys according to the invention may also contain at least one metal of the group consisting of zinc 0.1 to 14 per cent, and cadmium 0.1 to 24 per cent, the total amount of thallium, bismuth, lead, zinc, and cadmium jointly not exceeding 30 per cent. Bearing in mind the main objective of the invention, the amount of zinc should preferably be insufficient to cause any appreciable widening of the solidification interval of the alloys, since otherwise the advantage of freedom from micro-shrinkage cracks will progressively disappear. Thus the amount of zinc as alloying component should preferably not exceed about 1.5 per cent.

Since the corrosion resistance of casting alloys is enhanced by a fine grained and compact crystalline structure, the alloys of the present invention are equal with respect to corrosion resistance and especially with respect to resistance to stress corrosion, to the best of the hitherto known magnesium base alloys, so that the addition of manganese, which has hitherto been considered essential for improving the corrosion resistance but which, in this case, would prevent the zirconium from exercising its beneficial effects, can be dispensed with.

The fine grain which is formed in the solidification of the magnesium-zirconium alloys of the present invention, also persists after repeated remeltings and pourings of the alloys. The formation of the fine grained structure is practically independent of the cooling velocity of the poured alloys, and therefore occurs both in casting in permanent moulds and in sand moulds. It is equally immaterial to the fineness of grain whether the zirconium be introduced into pure magnesium or into a magnesium alloy, provided that the alloying components already present in the magnesium do not form any segregating intermetallic compounds with zirconium. The following are typical examples of suitable ternary or complex casting alloys in accordance with the invention.

Alloy	Tensile strength	Elongation	Yield point
	Kgs./sq. mm.	*Per cent*	*Kgs./sq. mm.*
Mg with— 1.0% Zr 3.0% Tl	18.5	21.2	6.5
Mg with— 1.0% Zr 20.0% Tl	21.0	16.0	7.4
Mg with— 1.0% Zr 0.2% Bi	16.5	9.0	7.0
Mg with— 1.0% Zr 1.6% Bi	13.9	5.6	7.1
Mg with— 1.0% Zr 4.0% Bi	12.7	5.2	5.4
Mg with— 1.0% Zr 2.0% Pb	17.1	11.6	5.8
Mg with— 1.0% Zr 15.0% Pb	15.2	6.8	5.7
Mg with— 1.0% Zr 3.0% Tl 0.2% Bi 3.0% Pb	16.9	9.4	5.2
Mg with— 1.0% Zr 3.0% Tl 3.0% Zn	23.2	10.4	12.2
Mg with— 1.0% Zr 0.2% Bi 8.0% Cd	18.0	10.5	7.0

The desirable properties of the above described alloys, and especially their excellent ductility and notched-bar impact tenacity, render them also suitable for wrought goods. Even a binary alloy containing up to about 2.0 per cent of zirconium exhibits, after extrusion, strength values equal to those of the usual wrought magnesium alloys containing considerable amounts of aluminium and on occasion also zinc, whilst being substantially superior thereto in respect of tenacity. The introduction of further permissible alloying components, such as thallium and/or bismuth and/or lead, increases the strength of the wrought alloys as well, or improves the ratio between tensile strength and elongation. Another important point is that the wrought alloys in particular are often enough distinguished from the known wrought alloys by their suitability for welding.

The mechanical properties obtainable with the known wrought magnesium alloys are approximately as follows:

Tensile strength	kgs. per sq. mm	28 to 37
Yield point	do	20 to 28
Elongation	per cent	7 to 16

(See "Werkstoffhandbuch Nichteisenmetalle," 1936, Sheet K4, alloys AZM, AZ 855, VI). By comparison, typical wrought alloys of the present invention give the following values:

Alloy	Tensile strength	Elongation	Yield point
	Kgs./sq. mm.	*Per cent*	*Kgs./sq. mm.*
Mg with— 1.0% Zr 3.0% Tl	27.7	14.4	23.9
Mg with— 1.0% Zr 20.0% Tl	29.3	16.0	25.7
Mg with— 1.0% Zr 2.0% Bi	28.1	15.3	19.9
Mg with— 1.0% Zr 8.0% Bi	28.5	9.0	22.2
Mg with— 1.0% Zr 2.0% Pb	27.3	15.1	21.2
Mg with— 1.0% Zr 15.0% Pb	29.0	14.0	24.9
Mg with— 1.0% Zr 3.0% Tl 0.2% Bi 3.0% Pb	28.4	12.5	24.3
Mg with— 1.0 Zr 3.0% Tl 3.0% Zn	36.8	11.1	31.9
Mg with— 1.0% Zr 0.2% Bi 5.0% Cd	29.6	14.4	24.7

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ALIEN PROPERTY CUSTODIAN

P-AMINO PHENYL-P'-AMINO PYRIDYL SULFONE AND A PROCESS OF MAKING THE SAME

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No Drawing. Application filed December 23, 1940

This invention relates to sulfones and more particularly to p-aminophenyl-p'-amino pyridyl sulfone and a method of making the same.

As is well known p,p'-diamino diphenyl sulfone has an extraordinary bactericide effect, but at the same time it is also rather toxic, so that it did not find use in human therapy.

Now, it has been found that a sulfone of similar constitution, wherein one phenyl residue is substituted by a pyridyl residue, is of almost equal effectiveness as the p,p'-diamino diphenyl sulfone, but is distinguished therefrom by a considerably lower toxicity. This sulfone corresponds to the following structural formula:

$$NH_2.C_6H_4.SO_2.C_5H_3N.NH_2$$

Compounds of this kind are obtained according to methods already known for the manufacture of sulfones (see, for instance, Houben-Weyl "Die Methoden der organischen Chemie", 3rd edition, vol. 3, pp. 1278 ff.).

As especially suitable there has proved the method consisting in reacting a salt of a benzene sulfinic acid, suitably an alkaline salt, containing in p-position to the sulfinic acid group an amino group or a group convertible thereinto, for instance, an acyl amino, nitro, nitroso, azo, hydrazo and the like groups, with a halogenated pyridine, also containing an amino group or a group convertible thereinto, suitably in p-position to the halogen.

This reaction may be illustrated by the following formulas

$$X.R.SO_2Me+Hal.R'X' \rightarrow X.R.SO_2.R'.X'+HalMe$$

wherein X and X' indicate an amino group or a group convertible thereinto, while R represents a benzene radical, R' a pyridyl radical, Me a metal, especially an alkaline metal and Hal halogen. Compare U. S. application Serial No. 237,926. As halogenated pyridine compounds there may be preferably employed compounds in which the halogen is rendered especially reactive by an activating substituent. Especially suitable for this purpose has proved the nitro group, which, after condensation, may be converted into the amino group. Thus, the p-amino phenyl-p'-amino pyridyl sulfone is obtained by reacting 2-chloro-5-nitro pyridine with the sodium salt of an acyl amino phenyl sulfinic acid with subsequent reduction and saponification. The transformation may be carried out while heating in a suitable solvent, for instance, in alcohol, or under pressure. The forming of the amino group is, if need be, brought about by the aid of hydrolysis or reduction or the like measures. The reduction of a nitro group present in the pyridyl residue may also be carried out simultaneously with the saponification of an acylamino group present in the phenyl residue. Thus, for instance, on reduction by means of stannous chloride or sodium hydrosulfite in glacial acetic acid at 40–60° C the nitro group is converted into the amino group while an acyl amino group present remains unchanged thereby. When using in the place of the above mentioned reducing agents stannous chloride and concentrated hydrochloric acid at a temperature of 80–90° C the acyl group is split off at the same time. Hence the latter method of reduction is of special importance as it saves one step, namely saponification of the acylamino group.

In order to obtain the sulfones claimed one may also proceed in such a manner that sulfides or sulfoxides containing an amino phenyl group as well as an amino pyridyl group, are oxidized to the corresponding sulfones. This reaction may be illustrated by the following formulas

$$X.R.So.R'.X' \rightarrow X.R.So_2R'.X'$$
$$X.R.S.R'.X' \rightarrow X.R.SO_2.R'.X'$$

wherein X and X', R and R' have the same meaning as indicated above. For this reaction such compounds are preferably used as starting material in which the amino groups are transformed into groups which are re-convertible into amino groups. The oxidation of these sulfides or sulfoxides is carried out in a customary manner, using, for instance, nitric acid, potassium permanganate, chromic acid, hydrogen peroxide, while heating, and others.

The sulfides used may be obtained by reacting the salts, especially the alkali salts of the corresponding mercapto compounds with the above mentioned halogenated pyridines. This reaction may be illustrated by the following formulas

$$X.R.S.Me+Hal.R'.X' \rightarrow X.R.S.R'.X'+HalMe$$

wherein X and X', R and R', Me and Hal have the same meaning as indicated above.

The sulfoxides employed for oxidation to sulfones may be produced, for instance, by rearrangement of the corresponding sulfinic acid amides which is facilitated by the presence of halogen hydrides or of the halogen hydride salt of the amine forming the amide. One may further proceed in such a manner that the corresponding sulfinic acids or their halogenides are condensed with aminopyridines. Such ways of procedure are described, for instance, in U. S.

application Serial No. 314,512 and German application Sch. 119,772 IVc/12q. The reactions described above may be illustrated by the following formulas:

1. X.R.So.NH.R′ $\xrightarrow{\text{rearrangement}}$ X.R.SO.R′.NH_2
2. X.R.SO_2H+R′.X′→X.R.SO.R′.X′+H_2O
3. X.R.SOHal+R′.X′→X.R.SO.R′.X′+HalH

Of course, other methods for making the corresponding sulfides and sulfoxides may be used likewise.

Furthermore, other methods of manufacturing the sulfones claimed may be employed, though in general lesser yields are obtained thereby than with the above-mentioned methods, and though mixtures of asymmetric and symmetric products may be produced. Of course, there are not to be employed such methods in which the amino groups or the groups convertible thereinto are influenced or even split off during reaction. Amongst these methods there may be mentioned the following:

The corresponding benzene sulfonic acid halogenides are condensed with pyridines containing a group convertible into the amino group, whereby the reaction is accelerated and facilitated by the presence of an aluminum halogenide, such an aluminum chloride. The condensation takes place according to the following formulas:

X.R.SO_2.Hal+R′.X′→X.R.SO_2.R′.X′+HHal

after condensation the groups convertible into amino groups present in the sulfone, may be transformed into amino groups, for instance, by the aid of hydrolysis or reduction, so as to yield p,p′-diamino phenyl pyridyl sulfone.

Instead of the benzene sulfonic acid halogenides the sulfonic acid themselves may be employed whereby the reaction is carried out in the presence of dehydrating agents, such as, for instance, phosphorus pentoxide. The yield obtained by this method, however, is appreciably lower than by the above mentioned processes. Reactions starting with sulfonic acids or their halogenides are described, for instance, in U. S. application Serial No. 335,868.

The following examples serve to illustrate the invention, without, however, limiting the same to them.

Example 1

200 gs of the sodium salt of p-acetyl amino benbene sulfinic acid are boiled under reflux with 156 gs of 2-chloro-5-nitro pyridine in 4,5 liters of alcohol for 7 to 8 hours. After allowing the reaction mixture to stand for a longer period of time the crystallized mass is filtered off, thoroughly washed with water and recrystallized from alcohol. Melting Point 225–226° C.

5 gs of the thus obtained p-acetyl amino phenyl-p′-nitro pyridyl sulfone are dissolved in 40 ccs of glacial acetic acid and within about 10 minutes 10 gs of sodium hydrosulfite dissolved in 50 ccs of water, are added to the hot solution while stirring. After heating on the water bath for another hour, the solution is evaporated to dryness in a vacuum, the residue treated with dilute sodium hydroxide solution until it shows lasting alkaline reaction, and recrystallized from dilute alcohol. Melting Point 271–272° C.

For saponification 3 gs of the p-acetyl amino phenyl-p′-amino pyridyl sulfone are heated to boiling in 60 ccs of 20% hydrochloric acid for half an hour, the cooled solution is mixed with ice water and rendered alkaline with sodium hydroxide solution while cooling. The p,p-diamino phenyl-pyridyl-sulfone precipitated melts at 183° C (from dilute alcohol).

The reduction of the nitro compound with stannous chloride in glacial acetic acid is carried out in the following way:

Over 6,4 gs of the nitro compound there are poured portion by portion 32 ccs of a 45% solution of stannous chloride in glacial acetic acid within about 30 minutes, keeping the temperature thereby at 50–60° C. After allowing the reaction mixture to stand for a longer period of time the tin double salt precipitated is treated with dilute sodium hydroxide solution in order to convert it into the free base.

Example 2

65 gs of the p-acetyl amino phenyl-p′-nitro pyridyl sulfone obtained according to Example 1 are suspended in 350 ccs of concentrated hydrochloric acid and reduced in the usual manner with 150 gs of stannous chloride in 250 ccs of concentrated hydrochloric acid at 40–50° C and thereupon heated for one more hour on the water bath. The tin double salt precipitates on standing. It is converted into the free base in the usual manner. The p,p′-diamino phenyl pyridyl sulfone with a melting point of 183–184° C (from dilute alcohol) is obtained with a yield of 30 gs.

Example 3

5,0 gs of the sodium salt of p-acetyl amino benzene sulfinic acid and 3,2 gs of 2-chloro-5-amino pyridine in 15 ccs of methanol are heated in a sealed tube up to 160° C for 8 hours. After cooling the contents of the tube are filtered off by suction and the filtrate is precipitated with water, whereby the p-acetylamino phenyl-p′-amino pyridyl sulfone precipitates at first in the form of an oil, which solidifies after long standing.

The acetyl compound is recrystallized from dilute alcohol and saponified to the p,p′-diamino phenyl pyridyl sulfone according to Example 1.

Example 4

3,8 gs of nitro phenyl sulfinic acid and 2,0 gs of anhydrous calcium acetate and 3,2 gs of 2-chloro-5-nitro pyridine in 120 ccs of ethanol are boiled under reflux for 7 to 8 hours. After cooling the precipitate obtained, representing p-nitro phenyl-p′-nitro pyridyl sulfone, is filtered off by suction, washed with water and recrystallized from glacial acetic acid. Melting Point 253–254° C. Yield 70% (of the theory).

3,6 gs of p-nitro phenyl-p′-nitro pyridyl sulfone are reduced in 200 ccs of methanol by means of hydrogen in the presence of a nickel catalyst. After having taken up the calculated amount of hydrogen the catalyst is filtered off and the filtrate is concentrated by evaporation. The thereby obtained raw product of p-amino-phenyl-p′-amino pyridyl sulfone melts at 183–184° C. Yield 70–80%.

Example 5

15,5 gs of p-nitro thiophenol and 15,8 gs. of 2-chloro-5-nitro pyridine are dissolved at 75° C in 370 ccs of ethanol. To this solution there are added 5,6 gs of potassium hydroxide in 200 ccs of ethanol. Subsequently the solution is heated to boiling for about half an hour on the steam bath. After cooling and filtering off by suction the crystalline precipitate, which, besides p-nitro-phenyl-p′-nitro pyridyl sulfide, contains p,p′-dinitro diphenyl sulfide, is recrystallized from methanol wherein the latter is insoluble. The p-

nitrophenyl-p'-nitro pyridyl sulfide melts at 125–126° C. Yield: 60–70%.

3,9 gs of p-nitro phenyl-p'-nitro pyridyl sulfide are dissolved while heating in 50 ccs of glacial acetic acid, and 3,0 gs of chromic acid anhydride are added to the solution at a temperature of about 90° C. Already during the introduction of the chromic acid a crystalline precipitate begins to form. After keeping the temperature for about 30 minutes at 90° C and cooling, the p-nitro phenyl-p'-nitro pyridyl sulfone obtained is filtered off by suction, washed with water and recrystallized from glacial acetic acid. Melting Point 253–254° C. Yield 50%.

The reduction of the dinitro compound to the diamino compound is carried out according to Example 4.

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VEHICLE LAMPS

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Application filed December 27, 1940

For effective avoidance of dazzle by the head lights of a road vehicle the lamp itself, and the reflector, must be screened from direct view from the front, at least up to the level of the eyes of approaching drivers and pedestrians, and the projected beam must be sharply defined at the top, without upward diffusion liable to dazzle.

Screens for preventing direct view of the lamp and reflector have been used. The object of my invention is to provide for the sharp demarcation above referred to, with the brightest light directly below the dark zone above the beam.

For that purpose I project the section through the rays of light of an optical system with light source in focus by means of a concave mirror.

A form of construction is shown in the accompanying drawing. The reflector 1 is a sector of an ellipsoidal body with an approximately horizontal bottom edge 2. At the focus 3 there is a lamp 4, and the reflector 1 is inside a housing 5, extending rearwards. Before the inner back part of the housing 5 is disposed a concave mirror, directed with its concave side to the reflector 1.

In the path of the pencil of rays 8 reflected by the reflector there is a diaphragm 9. Within the housing is disposed before the diaphragm 9 a concave mirror 14. The optical axis C—D of the mirror makes an acute angle with the axis A—B of the reflector and the focus of the mirror is approximately in the plane of the diaphragm. The second focus 6 of the reflector 1 is by the effect of the mirror 14 an unreal. The mirror 14 may be disposed before or behind the real second focus of the reflector 1. The housing 5 has on the front part a prolongation portion 7, which extends approximately until to a line 12 being the line of demarcation of the rays reflected by the mirror 14. It will be seen that all or practically all the light projected by the reflector issues below the edge of the part 7, as the rays diverge from the focus 6 close to this edge. The mirror 14 projects that section of the beam across which the diaphragm 9 lies, the result being that the rim of the diaphragm aperture produces a sharply defined demarcation 12 of the beam. Actually the sharp demarcation is only of importance at the top edge 12. It serves as a guide or pointer for adjusting the vehicle lamp so that it illuminates a long stretch of road in front without diffuse rays at a level where they may dazzle approaching drivers or pedestrians.

A sharp line of demarcation 12 is not obtained unless the focus of the mirror 14 is approximately in the plane of the diaphragm. If the focus is at any considerable distance from that plane the outline is blurred.

The projection of the section through a beam of light in the range of a diaphragm with a concave mirror is till now unknown and of a great advantage. While the thickness of a lens is remarkable and is destined by the situation over the diaphragm, the thickness of the mirror is uniform and can be likely slight. The loss of light is consequently small and there are not irregular rays. A lens must be of glass, whereas the mirror can be of metal. The mirror is disposed completely protected by the housing. A lens must be near the aperture of the housing.

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VEHICLE LAMPS

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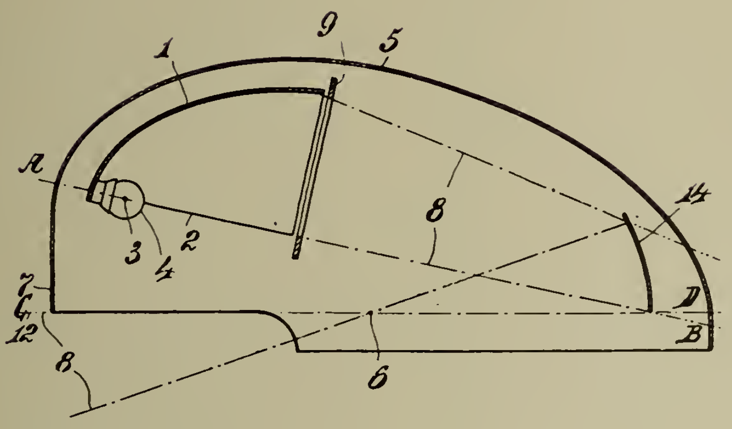

Friedrich Richard Dietrich
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By Otto Munk
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ALIEN PROPERTY CUSTODIAN

COUNTERWEIGHT ARRANGEMENT ON CRANK DRIVES

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Application filed January 2, 1941

The present invention relates to a counterweight arrangement on crank drives, particularly crank drives of piston engines having cylinders mounted in star-shaped fashion, for instance of internal combustion engines.

Hitherto the counterweights were exclusively arranged on the crank shaft. They serve the purpose of balancing the forces occurring at the crank shaft and thereby releasing the bearings of the crank shaft, so that the forces occurring in these bearings may without difficulty be governed. By a simple enlargement of the counterweights it would then always be possible to increase the number of revolutions without increasing the load acting upon the crank shaft bearings, if this measure or step would not be opposed to by the increasing stress on the connecting rod bearings.

The present invention obviates this draw-back and consists in this that the counterweights are arranged on the big end of the connecting rod. Hereby the rotating inertia forces are balanced at the point of origin, i. e. at the big end of the connecting rod itself. If the rotating masses of the connecting rods are balanced, then with increasing number of revolutions the relatively small oscillating inertia forces only are increased. Consequently, the number of revolutions may extraordinarily be increased without exceeding the permissible loads of the bearings at the end of the connecting rod. This arrangement according to the Invention has a particularly favorable effect in connection with motors arranged in star-shaped fashion in which the oscillating inertia forces are nearly independent on the crank angle so that they also may be balanced for the greater parts. In the arrangement according to the invention counterweights not only act upon the connecting rod bearings but, by way of the webs of the crank shafts, also upon the crank bearings and this in exactly the same manner as the counterweights hitherto mounted at the crank webs. Without departing from the spirit of the invention, the counterweight masses may exclusively be arranged at the end of the connecting rod or subdivided into counterweights on the main connecting rod and counterweights on the crank shaft. In connection with motors provided with a main—and an auxiliary connecting rod, particularly in connection wtih aircraft motors, arranged in star-shaped formation, the counterweights preferably are exclusively mounted on the connecting rod or on the primary connecting rod respectively. Due to the connecting rod bearings being released of rotating forces exerted by the masess, it is rendered possible to use plain bearings instead of roller bearings. Consequently, the end of the connecting rod itself can be made smaller and lighter and the points of pivoting the auxiliary connecting rod are located further towards the interior. The accelerating forces acting upon the auxiliary connecting rod, therefore, also become smaller. This again reduces the bending moments occurring at the shaft of the main connecting rod and the pressure on the gliding plane or the working surface of the main cylinder. The fact that the counterweights attack far outwardly at both sides of the end of the connecting rod also acts very favorably. This again renders possible to employ main connecting rods the shaft of which has the normal double T-cross section.

By a slight alteration of the construction, the counterweights may also be formed as centrifugal pendulums adapted to absorb torsional vibrations, if the counterweights are suspended with play on rings loosely mounted upon further rings. These last mentioned rings on the one hand are pivotally mounted upon the end of the connecting rod at both sides of this rod and on the other hand are connected to the crank shaft in a manner to rotate with the latter. The amplitudes of the oscillations of the counterweights are limited by resilient steps which are rendered effective only, after a predetermined amplitude of the oscillations of the counterweights has been reached This arrangement acts in the manner of the well known Taylor- or Salomon-pendulums and has the advantage of slight surface pressures occurring at the points of contact of the rolling off surfaces, because the pendulum rings as well as the bearing rings serving as pendulum shafts have a large diameter or a large bore respectively. Moreover, the amplitudes of the oscillations are rendered very small, because the entire counterweight oscillates in contradistinction to the hitherto known centrifugal pendulums. Due to the small amplitudes of the oscillations no substantial and constant friction occurs.

In the accompanying drawings two constructions according to the invention are shown by way of example.

In these drawings:

Figs. 1 and 2 show in longitudinal- and cross-section respectively simple counterweight arrangements on the end of a connecting rod,

Figs. 3 and 4 show a longitudinal- and a cross-section respectively of a counterweight arrangement simultaneously acting as oscillation absorber, and

Figs. 5 to 8 illustrate on a larger scale details of the modification shown in Figs. 3 and 4.

In the construction illustrated in Fig. 1 a plain bearing 2 is provided upon the crank pin 1. Slideably arranged upon this is the end 3 of the connecting rod. At both sides of the connecting rod 4 and as far as possible towards the exterior the end 3 of the connecting rod 4 is provided with two raceways 5, 5 each supporting a roller bearing 6 on the outer rings 7, 7 of which the counterweights 8, 8 are suspended or favourably a sliding bearing or another suitable bearing. The counterweights each have an external yoke 9, 9, into which engages nooses 10, 10 extending downwardly from the crank shaft web. On rotation of the crank shaft, the nooses 10 carry with them the counterweights, so that with regard to the axis of the crank shaft the counterweights always are located opposite the end of the connecting rod and in this manner neutralize the centrifugal forces of the latter. By means of the nooses 10 the counterweights 8 are also axially fixed.

When using a main connecting rod with a plurality of auxiliary connecting rods, the auxiliary connecting rods 11 preferably are, as may be seen from Fig. 1, arranged in the centre plane of the main connecting rod between the counterweights 8. The operation of this device easily may be understood from the drawing and has been exhaustively explained in the preamble to the specification.

The modification of the device shown in Figs. 3 and 4 substantially corresponds to the device illustrated in Figs. 1 and 2 with the difference, however, that according to the construction shown in Figs. 3 and 4 each of the bearing rings 7, 7 of the counterweights 8, 8 is suspended with a certain play from another bearing ring 12, 12. These bearing rings 12, 12 are arranged upon sliding rings 13, 13 which are provided on the head of the connecting rod in place of the roller raceways. Moreover, the bearing rings 12, 12 are coupled to the crank shaft by pins 14, 14 and rotate with this shaft. Instead of the yokes 9 each of the counterweights 8, shown in this construction, is provided with a downwardly extending outwardly directed flange 15, 15 (Fig. 5) having two stops 16, 16 at each side. Opposite these stops spring buffers 17, 17 are located which are provided at the crank shaft webs 10, 10.

The arrangement is such that the stops 16 have a certain freedom of movement within the plane of oscillation of the counterweights 8 before they come into contact with the spring buffers 17. In a direction vertically to the plane of oscillations the counterweights at the stops 16 are guided in slots 18 of the casings 19 of the spring buffers 17 as may be gathered from Fig. 6. This slot guide has the purpose of preventing oscillating movements of the counterweights in the direction of the axis of the crank shaft. In order to allow an easy mounting of all the bushings and bearing rings without being compelled to divide the crank shaft these rings are subdivided to a large extent. The sliding bearing 2 consists of two ordinary bearing bushing-halves. The big end 3 of the connecting rod also is subdivided in the usual manner and the two parts are screwed together, as shown at 20 in Fig. 4. The sliding ring 13 too is formed of two parts which in the manner of a two-part thin-walled bearing bushing are kept together by pressure exerted by pressing. The bearing ring 12 also is formed of two parts and the ends of the two ring halves are joined by mortise and riveted together as shown in Figs. 7 and 8. The bearing ring 7 of the counterweights 8 also is constructed in two parts and at 21 the two ring halves are screwed together. Instead of subdividing the rings, the pin 1 of the crank shaft also may be subdivided and the two parts may be screwed together for instance by the simultaneous use of a toothed separation joint.

The arrangement according to Figs. 3 and 4 acts in exactly the same manner as the construction according to Figs. 1 and 2 and, moreover, in the manner of a Taylor- or Salomon-pendulum whereby the pendulum mass is energized to an own frequency which counteracts the frequencies occurring at the crank shaft. Instead of the two weights 8, 8 a single weight also could be arranged in the transverse plane of the connecting rod 4 if such an arrangement is not prevented by the auxiliary connecting rods 11. The invention also may be employed in engines with cylinders arranged in series in one row.

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COUNTERWEIGHT ARRANGEMENT ON CRANK DRIVES

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2 Sheets-Sheet 1

Fig.1.

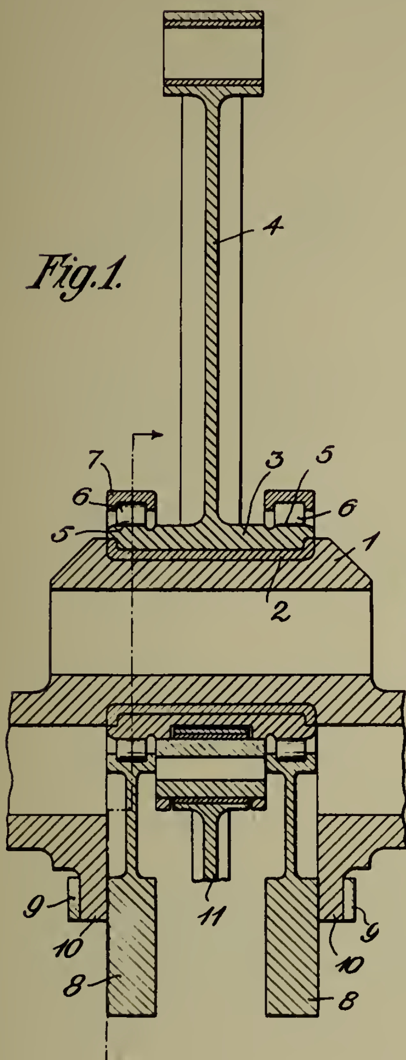
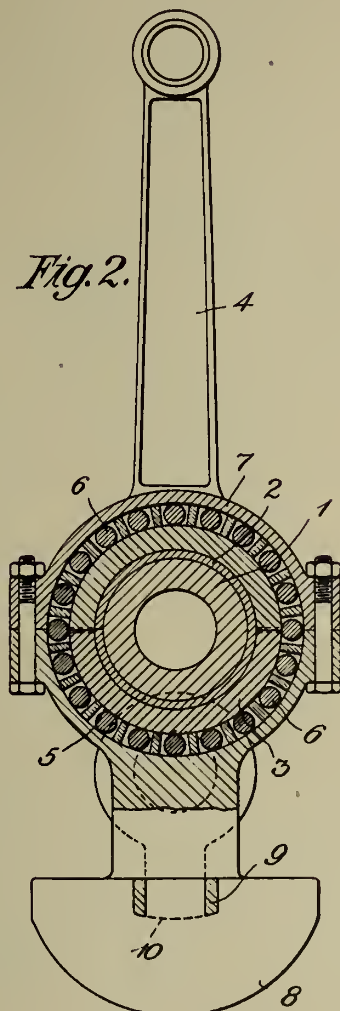


Fig.2.



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2 Sheets-Sheet 2

Fig.3.

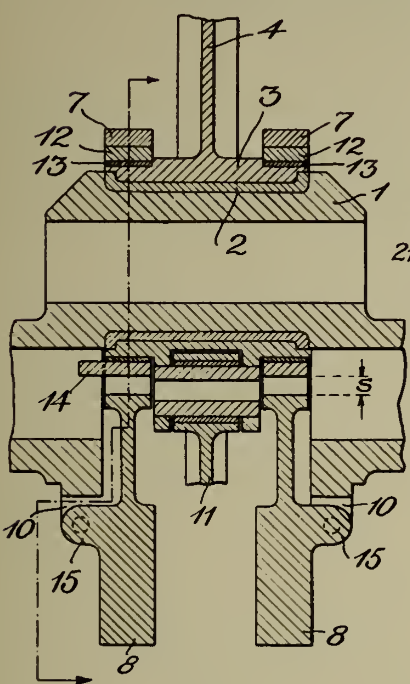

Fig.4.

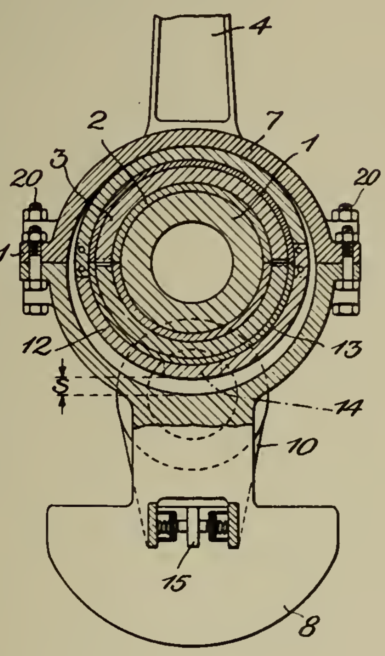

Fig.5.

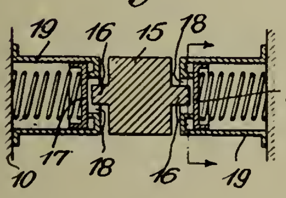

Fig.6.

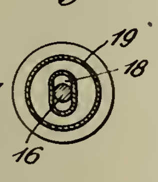

Fig.7.

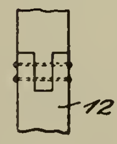

Fig.8.

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DEVICES FOR SUPPRESSING TORSIONAL OSCILLATIONS

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Application filed January 8, 1941

The present invention relates to devices for suppressing torsional oscillations of crank shafts. In a manner known per se the absorption of the oscillation is effected by resonance pendulums. In connection with constructions known hitherto, this method, however, has the draw-back that its operation is not sufficiently free from sliding friction. Therefore, it is impossible or rather unsufficiently only possible to effectively control torsional oscillations, because the period of oscillation of the pendulum is changed by the sliding friction. The present invention is concerned with the suspension and bedding of the oscillating masses and, due to its construction which perfectly obviates any sliding, results in being free from friction to a large extent, thereby substantially improving the selection.

In the accompanying drawings two constructions according to the invention are shown by way of example.

In these drawings:

Fig. 1 diagrammatically shows an arrangement of the oscillation masses on the web of the crank shaft by means of rolling off according to a cycloide,

Fig. 2 shows an arrangement similar to that illustrated in Fig. 1, but operating by rolling off according to an evolvent.

Fig. 3 is a section on line A—A of Fig. 2, and

Fig. 4 shows a section on line B—B of Fig. 2.

In Fig. 1 the web of the crank shaft is designated 1. Mounted upon an extension 13 of the crank shaft web 1, serving for the suspension of a counterweight, is a bolt 3 of circular cross section extending in parallel to the axis of the crank shaft. On the bolt 3 the oscillating mass 2 is arranged which has a circular recess 9. Instead of mounting one oscillating mass on one web it is also possible to mount several masses on several webs. The circular recess 9 may also be replaced by a plane recess. To prevent a lateral displacement in the direction of the arrow shown in Fig. 1, rollers 4 are journalled, preferably by needles 5, by means of bolts 6 rigidly connected to the oscillating mass 2. In the manner characteristic to the method of absorbing oscillations by resonance, on rotation of the crank shaft pendulum movements of the oscillating mass 2 occur which consist in the mass 2 rolling off upon the bolt 3 along the contact surfaces 3 and 9. During this pendulum movement the centre point of the rollers 4 moves in a curve belonging to the group of cycloid curves. The counter faces 7 upon which the rollers 4 roll off represent equidistances to these cycloids. These surfaces may be integral with the extension 13 or for reasons of manufacture may be inserted as has been indicated at 12 in Fig. 1. From this arrangement it may be gathered that the oscillating mass 2 now is compelled to roll off upon the bolt 3 and that the rollers 4, journalled by means of the needles 5, reduce to a minimum the friction at the lateral contact faces 7. If in some cases the rollers cannot be arranged in the manner explained above, then the roller 4 may be replaced by a curve eventually by a plane also which is inserted or manufactured in the oscillating mass 2.

From Fig. 2 it may be seen that the oscillating mass 2 may be provided with a plane rolling off surface 10 with which it rolls off along the contact face 11 in the form of a part of a circle. The pathways of the centre points of the rollers resulting therefrom are evolvents 8. The equidistances also are in the form of evolvents. To place the oscillating mass 2 upon the web of the crank shaft, the mass 2 may for instance be provided with lateral slots, or the bolt 3 or the member provided with the contact surface 11 respectively may, after placing the mass 2 upon the web of the crank shaft, be inserted from the side of the web of the crank shaft and be fixed in any suitable manner.

There may be formed shoulders on the extension 13 or abutments in order to prevent a movement of the oscillating masses in the direction to the axis, when the engine is running slow on starting or on decreasing its revolution so that the centrifugal forces decrease approximately on 0.

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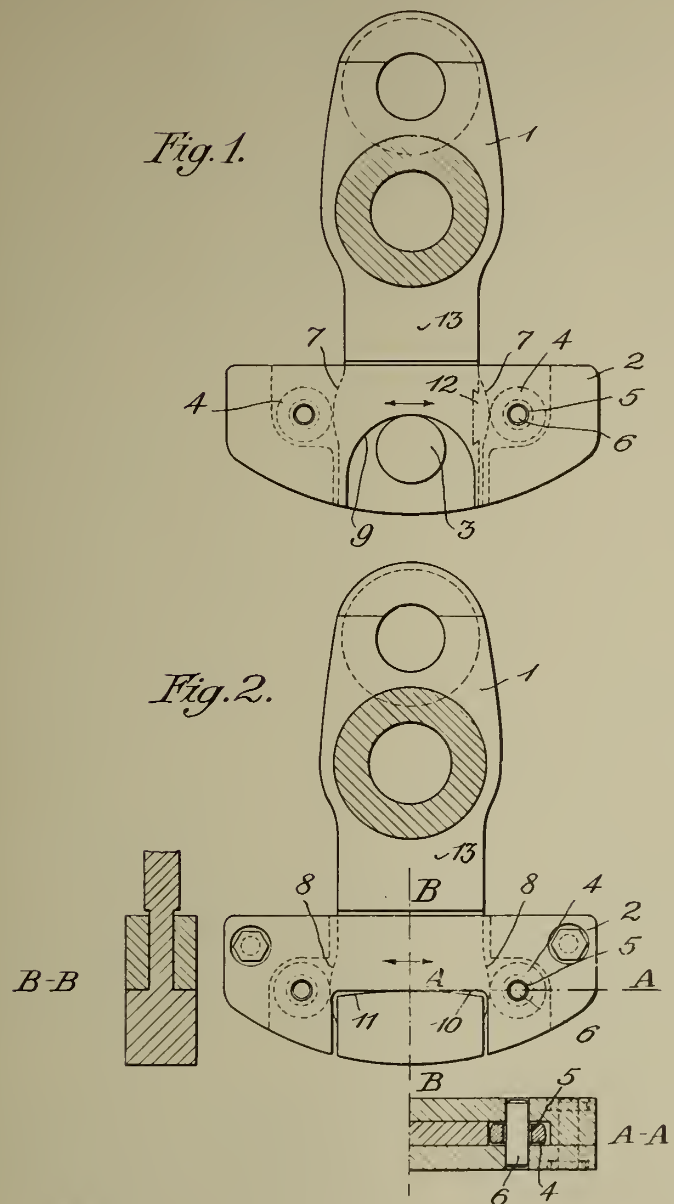

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ALIEN PROPERTY CUSTODIAN

ONE-PIECE SAFETY RAZORS

Giuseppe Lenta, Beausoleil, France; vested in the Alien Property Custodian

Application filed January 18, 1941

My invention relates to improvements in one-piece safety razors in which the blade is clamped between a guard plate and a comb plate; and the objects of my improvements are, first, to provide a safety razor in which all parts are held together and, therefore, cannot be mislaid or become lost; and, second, to afford facilities for readily exchanging the blade and for a quick cleaning of the razor.

I attain these objects by the safety razor illustrated, in three forms of invention, in the accompanying drawings, in which—

Fig. 1 is a front elevation of one form of invention; Fig. 2, a side elevation of same with the guard plate and blade raised into a position nearly vertical to the comb plate for the purpose of exchanging the blade or cleaning the razor; Fig. 3, a top plan view of the comb plate; Fig. 4, a perspective view of the guard plate; Fig. 5, a view of the tenons of the guard plate; Fig. 6, a side elevation of a second form of invention; Fig. 7, a view of the screw handle pertaining to the latter; Fig. 8, a front elevation of the guard plate pertaining to the second form of invention; Fig. 9, a front elevation of a third form of invention; Fig. 9, a partial side elevation of the latter; and Figs. 11–12, a plan view of the blade used in the razor according to my invention.

Figs. 1–4 illustrate the most simple form of invention. The handle **4** is split at one end to form two bulbed wings **5**. The comb plate (Fig. 3) comprises two symmmetrical halves **2** and **3**, separated throughout by the longitudinal slot **1**, each of which is fastly secured to one of the wings **5**. The guard plate **6** is inserted into the razor by slightly springing apart the wings **5** and sliding the tenon **7**—**10** into the slot **1** and onto the comb plate **2**—**3**.

The guard plate **6** (Fig. 4) possesses two lateral tenons **7**—**10** which fulfill three functions: the centering of the blade, its clamping fast between comb and guard plate, and the guiding of the guard plate during the tilting operation (Fig. 2). These tenons or heels possess a semi-cylindrical portion **7**, which correspond to the tenons of the common guard plates, a portion **8** somewhat wider which eliminates the vertical play of the plate, and a heel **9** which abuts against the wings **5** during the tilting operation and, therefore, also prevents the guard plate from becoming entirely separated from the comb plate. Two grooves **10** on these tenons permit the guard plate to slide easily onto the comb plate and thus assure the clamping fast of the blade between the said plates.

The blade **11** (Fig. 10) which is provided for this type of razor and for those based on the same principle described in the following, comprises a central opening **11′** and two semicircular portions on its longitudinal axis, which abut against the tenons **7** and are guided by the latter. It is obvious that these blades also may be used in any safety razor which is provided with the ordinary type of guard plate.

The form of invention shown in Figs. 5–7 differs from the one described in that the guard plate possesses a partially threaded central tenon **12** (Fig. 7) onto which a handle **13** is screwed. The latter is inserted into the tube or outside handle **4** and serves for pulling the guard plate down onto the comb plate. The handle **13** comprises a vertically disposed groove **14** and a helicoidal groove **15** situated between two throat portions **16** and **17** of which the latter is of greater height. A tenon **18**, provided by pushing the material of the tube **4** inside, permits by guiding the said grooves of obtaining two different lengths of the handle **13** before the latter is being screwed to the tenon **12**.

These results are obtained by the following operations:

One introduces the handle **13** into the tube **4** so that the vertical groove **14** is engaged by the tenon **18**. The handle then advances until the tenon **18** is situated in the throat **16**. If, now, the handle is slightly turned, it becomes locked in this position. If, on the other hand, one continues turning the handle by pulling down the tube **4**, the tenon **18** becomes engaged by the helicoidal groove **15** and arrives in the throat **17** wherein it may be locked by a slight turning. By further propelling the handle **13**, the tenon **18** moves in the throat **17** and the tenon **12** is screwed into the handle **13**, thereby pulling down the guard plate onto the comb plate.

The tube **4** is made of a rigid material, and the wings **5**, therefore, do not act as springs so that it is not possible to take out the special guard plate. One, therefore, has to use the blade according to Fig. 10. By providing resilient wings on this form of invention, however, the special type of guard plate may be withdrawn and an ordinary guard plate substituted therefor, in which case any ordinary blade may be used. The form of invention according to Figs. 1–4 also may be provided with the guard plate shown in Fig. 7 together with the handle **13**, or with the normal type of guard plate.

In the form of invention according to Figs. 8 and 9 the wings **5** are resilient so that the guard plate may be withdrawn by slightly springing apart the comb plate portions **2** and **3**. A retaining device of the guard plate permits of converting this razor into a "one-piece" razor. The said device comprises a ring **19** manipulated by means of the exterior pushers **20** which co-act with two small plates **21** abutting against the guard plate. The latter may be tilted into the vertical position, but it cannot be separated from the comb plate. The ring **19**, the pushers **20** and the plates **21** are made of one piece.

GIUSEPPE LENTA.

PUBLISHED | G. LENTA | Serial No.
JUNE 1, 1943. | ONE-PIECE SAFETY RAZORS | 375,075
BY A. P. C. | Filed Jan. 18, 1941 | 2 Sheets–Sheet 1

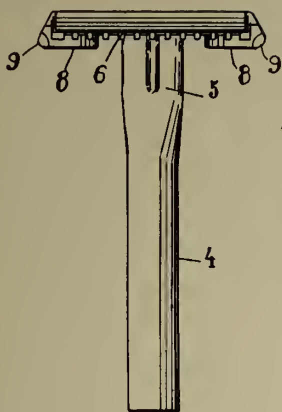


Fig. 1.

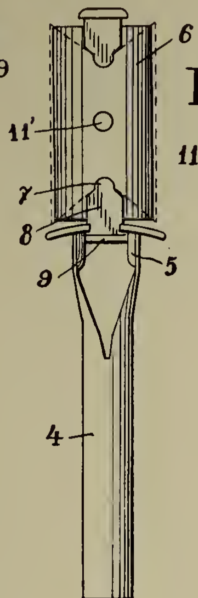


Fig. 2.

Fig. 3.

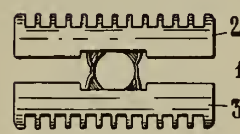


Fig. 5.

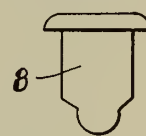
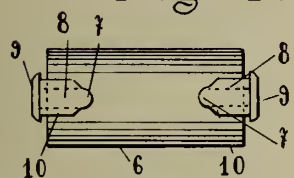


Fig. 5a.

Fig. 4.



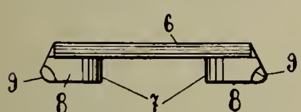


Fig. 4a.

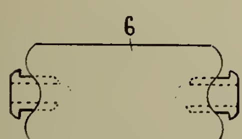


Fig. 4b.

Fig. 6.

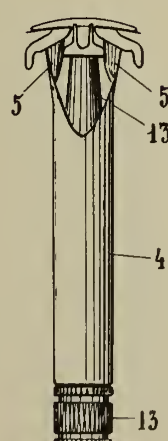


Fig. 5b.

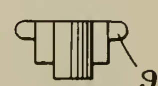
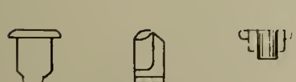


Fig. 5.



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ONE-PIECE SAFETY RAZORS
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Serial No.
375,075
2 Sheets-Sheet 2

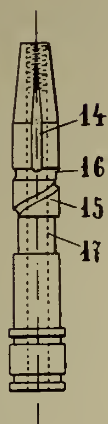

Fig. 7.

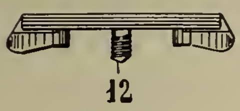

Fig. 8.

Fig. 9.

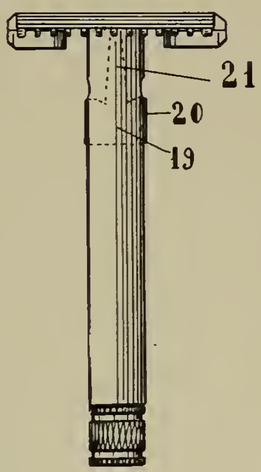

Fig. 10.

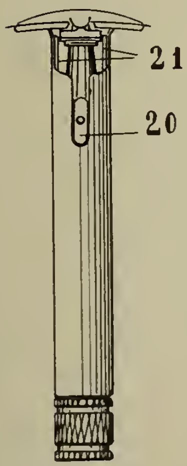

Fig. 11.

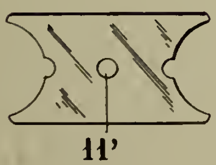

Fig. 12.

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Published June 1, 1943

Serial No. 375,915

ALIEN PROPERTY CUSTODIAN

DYNAMIC MICROPHONE

Helmut Batsch, Berlin, Germany; vested in the
Alien Property Custodian

Application filed January 25, 1941

This invention relates to a new and useful dynamic microphone.

The recently developed dynamic plunger coil microphones offer a great advantage because they require no biasing source such as, for instance, the carbon microphones, or the condenser microphones. On the other hand, except for a few rather complicated constructions, this microphone is not satisfactory in view of its frequency pattern. In fact, if these microphones are built with low pitch, the sensitivity decreases with an an increase of the frequency. When choosing a high tuning, the low frequencies are poorly reproduced. Hence, in some modes of construction, a tuning in the intermediate frequency range is employed thus admitting the drawbacks entailed thereby.

It is already known to arrange such diaphragms in spaces which are filled out with cotton, or like material, whereby the diaphragms act upon said spaces. These damping arrangements have a rather selective effect and furthermore the cotton fillings, or like fillings, are hygroscopic and influenced by the temperature such that the damping is not constant.

In accordance with the present invention the drawbacks of the known plunger coil microphones are eliminated in that a low tuned oscillatory system is employed and that the influence of the falling frequency pattern is checked by a damping depending on the frequency and which is produced by a damping device comprising a hollow cylinder surrounding the center pole at a short distance therefrom and adjoining the pole plate. The new device is of very simple construction and produces a damping which acts safely, is insensitive to moisture and does not vary on account of the temperature, in that the air forced out by the diaphragm at the side of the magnet is forced through a narrow channel which is formed by a hollow cylinder adjoining the pole plate and whose inside has a very small distance from the magnet core. This damping arrangement acts especially on the range of the low and intermediate frequencies. Eventually, it may be desirable to keep lower the damping for the low frequencies. This can be accomplished by drilling holes at a few places into the cylinder which surrounds the core of the magnet. At low frequencies, the pressure fluctuations can be equalized across the holes. Then, only the part of the channel between pole plate and these openings acts as damping resistance. At high frequencies the pressure exchange is prevented by the mass of air oscillating in the openings. For this frequency range the entire length of the channel acts as damping resistance.

The accompanying figure shows a form of construction of the subject matter of the present invention given by way of example. The calotte-like diaphragm M is mounted on the level pole plate P. It carries the oscillatory coil S*ch* which is immersed into the air gap S*p* between the pole plate P and the center pole K. The block-shaped outer magnets made preferably from an aluminum-nickel-steel-alloy, supply the required magnetic flux. The center pole K, the pole plate P and the lower pole plate U consist of soft iron. The center pole K has placed around itself at short distance the damping cylinder D arranged in accordance with the present invention. This damping cylinder extends up to the pole plate P. In order to maintain lower the damping for the low frequencies, holes L may be provided in the damping cylinder D. The distance of the damping cylinder from the center pole K is chosen in a form of construction equal to 0,4 mm.

The subject matter of the present invention may also be employed, as is obvious, in magnet systems and oscillation systems of different constructions, such as for instance in systems having a rectangular oscillation coil whereby the arrangement according to the invention is modified accordingly.

HELMUT BATSCH.

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DYNAMIC MICROPHONE

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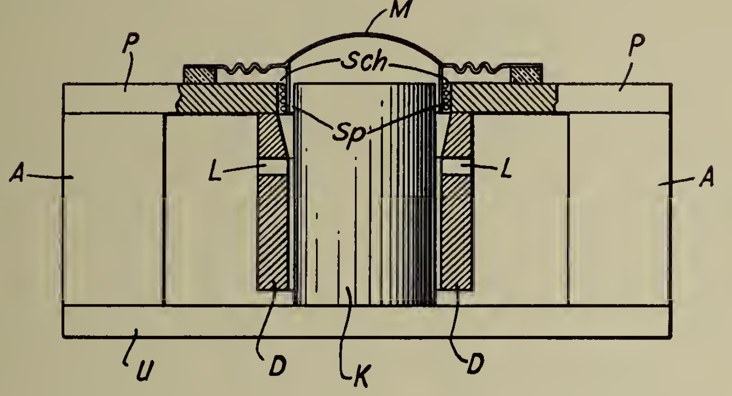
Serial No.
375,915



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Published June 1, 1943

Serial No. 376,385

ALIEN PROPERTY CUSTODIAN

RIVETING APPARATUS

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Application filed January 28, 1941

This invention relates to a riveting apparatus of the type comprising means for automatic feeding of the rivets to the riveting place and gripping members, such as, tongs or the like arranged in the holding-up hammer or head cup portion, for holding the rivets in position before the riveting operation.

In one known apparatus of this type, the rivets coming from the rivet supply are fed to the gripping members through a pipe terminating on that side of the work pieces to be riveted where the rivet stamp is arranged, i. e., on the side facing away from the holding-up hammer. In this case, the space between the stamp and the holding-up hammer has to be cleared by the work pieces each time for transferring a rivet from the feed pipe to the gripping members. It follows that the work pieces to be riveted have to be withdrawn each time a rivet has been closed, for introduction of the next rivet into the gripping members. This operation, while being time-wasting already with small work pieces, is unpracticable for large work pieces, such as those, for instance, occurring in aircraft construction.

It is an important object of the present invention to provide means for avoiding this drawback of the known apparatus.

According to the invention, the rivet feeding pipe is connected to the holding-up hammer part of the riveting apparatus, in such a manner that the rivets in their travel to the gripping members need not be passed through the space between the stamp part and the holding-up hammer. Thus, the work pieces occupying this space need not be removed after each riveting operation, but have to be moved merely from the finished rivet to the next bore.

According to a further important feature of the invention, the rivet feeding pipe is connected to the casing for the holding-up hammer on that side of the rivet gripping members which faces away from the work pieces. This particular arrangement permits the remaining conveyance of the rivets into the rivet gripping members to be effected by the holding-up hammer which pushes the rivets between the gripping members or nippers. This affords a considerable simplification in the construction and operation of the apparatus, avoiding intricate positive control of the gripping members.

The invention will be better understood by reference to the following detailed description in connection with the accompanying drawing showing by way of example and purely schematically a preferred embodiment of the invention and in which:

Fig. 1 is a fragmentary elevation, partly in section, of a riveting apparatus having the invention applied thereto.

Fig. 2 is an elevation, partly in section, of the upper portion of the holding-up hammer including the connection with the end of the rivet feeding pipe, on a larger scale.

Fig. 3 is a fragmentary axial section through the holding-up hammer part on a plane at right angles to the plane of Fig. 2, the head cup and a rivet shown in their positions taken up immediately after the rivet has been passed from the rivet feeding pipe into the casing for the head cup.

Fig. 4 is a section similar to Fig. 3, but with the head cup and rivet in their positions immediately after introduction of the rivet between the gripping members.

Fig. 5 is a section similar to Figs. 3 and 4, but showing the head cup and the rivet in their positions after the rivet has been pushed right through its bore.

Similar characters of reference denote similar parts in the different figures.

Referring now to the drawings in greater detail, and first to Fig. 1, it will be seen that a frame 1 for the riveting apparatus, which is only roughly indicated, comprises two main parts, i. e., the stamp part I including the stamp 2 and the holding-down member 3, and the holding-up hammer part II, including the holding-up hammer or head cup 6 which is slidably mounted in the bore of an exteriorly threaded spindle-shaped member 4. In its raised position the head cup 6 serves as a support for the rivet while the stamp 2 is producing the closing head thereof. This, of course, is the normal function of the head cup in riveting, but according to the present invention the head cup also performs various other functions which will be hereinafter described.

The head cup 6 is operated by means of a device consisting of a wedge member 8, a compressed air cylinder 9 and a piston 10 slidable in the cylinder and connected with the wedge member 8 through a rod 10′, the head cup 6 being held in engagement with the wedge member 8 by means of a helical spring 7 accommodated in a bore of spindle 4 and bearing on a collar of the head cup 6. By admitting compressed air into the cylinder 9, through pipe 12, the piston 10 with the wedge member 8 can be moved to the right, against action of a helical spring 11 serv-

ing to return the piston 10 with the wedge member 8 on decrease of the air pressure in cylinder 9. The pipe 12 communicates with a pipe 14 which is connected to a supply of compressed air (not shown), a change-over cock being connected between pipes 12 and 14 and establishing communication between the two pipes with position A of switching lever 13', as shown, while disconnecting the pipes with position B of lever 13', indicated in dot and dash lines, and establishing communication between pipe 14 and pipe 15 which moreover, through a second change-over cock 16, is adapted to communicate with the rivet feeding pipe 20. Further, a pipe 19 connects cock 16 with the branch 30 of a rivet supply or magazine 17 which receives the rivets through a branch 17', a pair of rotary brushes serving to assort the rivets by sweeping them into a suitable slot 31 in the cylindrical drum 17 and, from this slot, into branch 30, with their heads up.

The plug 32 of the change-over cock 16 is provided with a cross channel 33 which conforms to the shape of the rivets. In one end position of the plug 32, shown in Fig. 1, this cross channel 33 is disposed vertical for reception of a rivet dropping through pipe 19, while in its position turned through 90°, corresponding to position B of lever 13', the cross channel 33 is horizontally disposed for establishing connection between pipes 15 and 20. As best seen from Fig. 2, showing the upper end of pipe 20 and its connection to the upper part of the head cup arrangement II, the rivets through pipe 20 reach the inner space 21 of the guide member 27 for the head cup 6.

The guide member 27 also serves for supporting the nipper device for the rivets, which includes two jaws or gripping members 22 acting like tongs and being controlled by three-armed levers 26 engaging the jaws 22 by their upper arms 26'' and fulcrumed in the member 27 by means of pivots 25. The member 27 with the levers 26 by means of its lower sleeve portion 27' is mounted to slide on a member 28 which is screwed to the top end of spindle 4 and in its central bore receives the lower thickened portion of head cup 6. Downward sliding of member 27 is caused by the stamp part 2, 3 of the riveting apparatus, against action of a helical return spring 23 supported on member 28 and leaning at its upper end against a flanged spring plate 24 which in turn engages the lower arms 26' of lever 26. The whole mechanism is enclosed in a surrounding sleeve 34 screwed to an exterior thread of member 28.

The operation of the apparatus is as follows: During the riveting operation, i. e., during formation of the closing head by means of the rivet stamp 2, the operating lever 13' of cock 13 is in position A, as shown in Fig. 1, and the operating lever 16' of cock 16, positively coupled to lever 13' by a coupling rod 35, is in a position aligning the cross bore 33 of the plug 32 with pipe 19, for reception of a rivet falling down therethrough. After the riveting operation has been finished, the rivet stamp 2 and the holding-down member 3 are raised and the lever 13' of cock 13 is moved into its position B, whereby the plug 32 of cock 16 is also moved into its other end position for interconnecting pipes 15 and 20 and shutting off the lower end of pipe 19. In position B of cock 13 the compressed air contained in cylinder 9 from the preceding operation is allowed to flow into pipe 15, through pipe 12, thereby conveying the rivet in plug 32 of cock 16, through pipe 20, into the space 21 within casing 27, Fig. 2. The rivet thereby comes to lie upon the upper end face of head cup 6, as shown in Fig. 3. Now, the operating lever 13' of cock 13 is again moved into position A, thereby establishing communication between cylinder 9 and the supply of compressed air connected to pipe 14. Under action of the compressed air brought to bear upon piston 10 through pipe 14, cock 13 and pipe 12, the piston is moved to the right, against action of spring 11, taking along the wedge member 8. The lower end of head cup 6 which at the beginning of this movement had been engaged on the front tip of the wedge, under action of helical spring 7, now slides upwards on the inclined face of the wedge, whereby the rivet lying on the upper end of the head cup is raised and pushed between the jaws 22 which by the rivet shaft are spread correspondingly, against the action of spring 23, this action being transmitted upon the jaws 22 through arms 26' and 26'' of three-armed levers 26. The rivet forced between the jaws 22 is thus safely held in its upright position, protruding from the upper surface 27'' of member 27 which serves as a support for the work pieces 36, 37 to be riveted. This permits the bores in the work pieces to be readily engaged over the rivet, so that the work pieces are secured in position for the riveting operation.

As best seen from Fig. 4, the lower end of head cup 6 in the upper position thereof has passed from the inclined surface of wedge 8 to its upper horizontal face. It follows that no reaction pressure is transmitted from head cup 6 to piston 10, the driving system thus being self-locking in this position and enabled to receive considerable forces acting upon the head cup in the riveting operation, without any yielding.

Continuing the riveting process, the holding-down member 3 engages the work pieces 36, 37 to be riveted, depressing them jointly with the member 27, the claws 22 and the three-armed lever 26, against action of the helical spring 23. In this phase of the operation, the head cup 6 is maintained in a static relation on the horizontal top face of wedge member 8, so that a relative motion of the three-armed levers 26 is caused with respect to the head cup. By this relative motion the inner arms 26''' of levers 26 are swung outwards by the conical collar 6' of head cup 6, against action of springs 23, which also causes outward swinging of the upwardly directed arms 26'' of levers 26. The jaws 22 therefore release the rivet clamped between them, so that the sheets 36, 37 under depressing action of the holding-down member 3 of the stamp part engage the countersunk head of the rivet which is countersunk into the sheets as shown in Fig. 5.

The rivet stamp 2 now makes the closing head of the rivet, opposed by the head cup which with its lower end is still bearing on the horizontal surface of wedge 8 in self-locking relation. The closing head being finished, lever 13' is again moved from position A to position B, for discharging the compressed air from cylinder 9. Piston 10 with its wedge member 8 therefore is moved leftward, under action of spring 11 and the head cup 6 is allowed to go down, sliding downwards on the incline of wedge member 8. The apparatus is now ready for another cycle of riveting operations.

In order to make the head-cup part II to con-

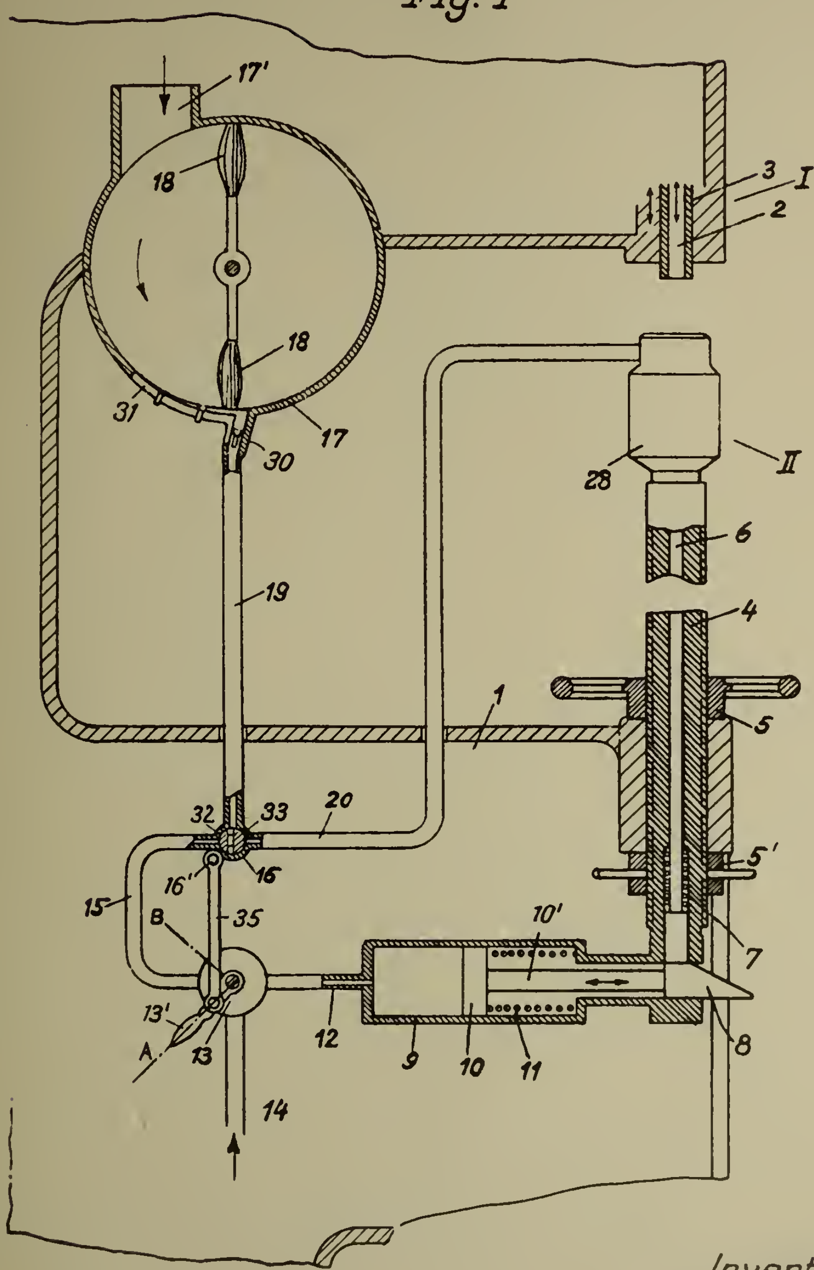
form to the shape of the work pieces to be riveted, the same is provided for raising and lowering in the frame 1 by screwing the nuts 5 and 5' on spindle 4. To this end, the upper nut 5 is provided with a hand wheel while the lower nut 5' is provided with spokes. Further, the pipes 12 and 20 are made flexible or provided with flexible portions, for connection to a stationary rivet magazine 17; or the rivet magazine may be connected with the head cup part II through rigid pipes, for vertical adjustment jointly with the head cup system.

The method and apparatus of the present invention have been described in detail with reference to specific embodiments. It is to be understood, however, that the invention is not limited by such specific reference but is broader in scope and capable of other embodiments than those specifically described and illustrated in the drawing.

HUBERT MÖRTL.

PUBLISHED	H. MÖRTL	Serial No.
JUNE 1, 1943.	RIVETING APPARATUS	376,385
BY A. P. C.	Filed Jan. 28, 1941	5 Sheets-Sheet 1

Fig. 1



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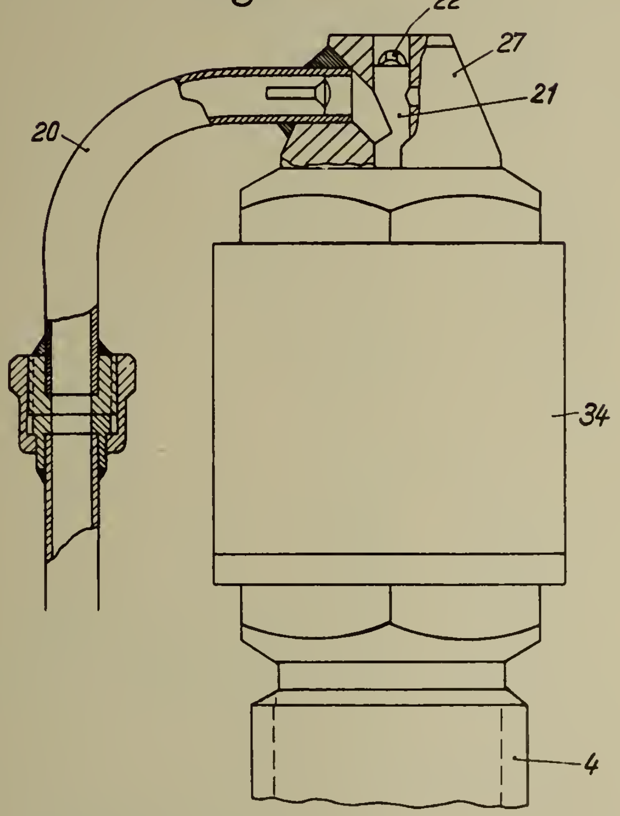
BY A. P. C.	Filed Jan. 28, 1941	5 Sheets-Sheet 2

Fig. 2



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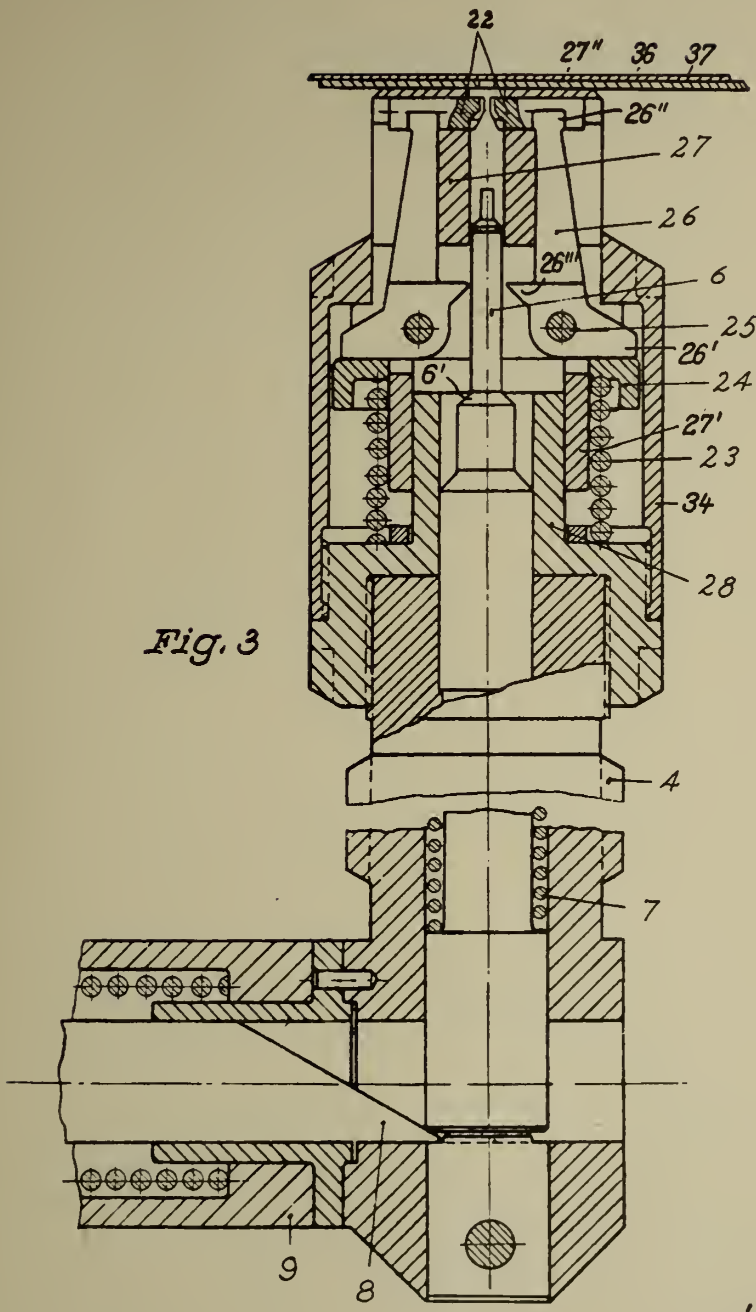

Fig. 3

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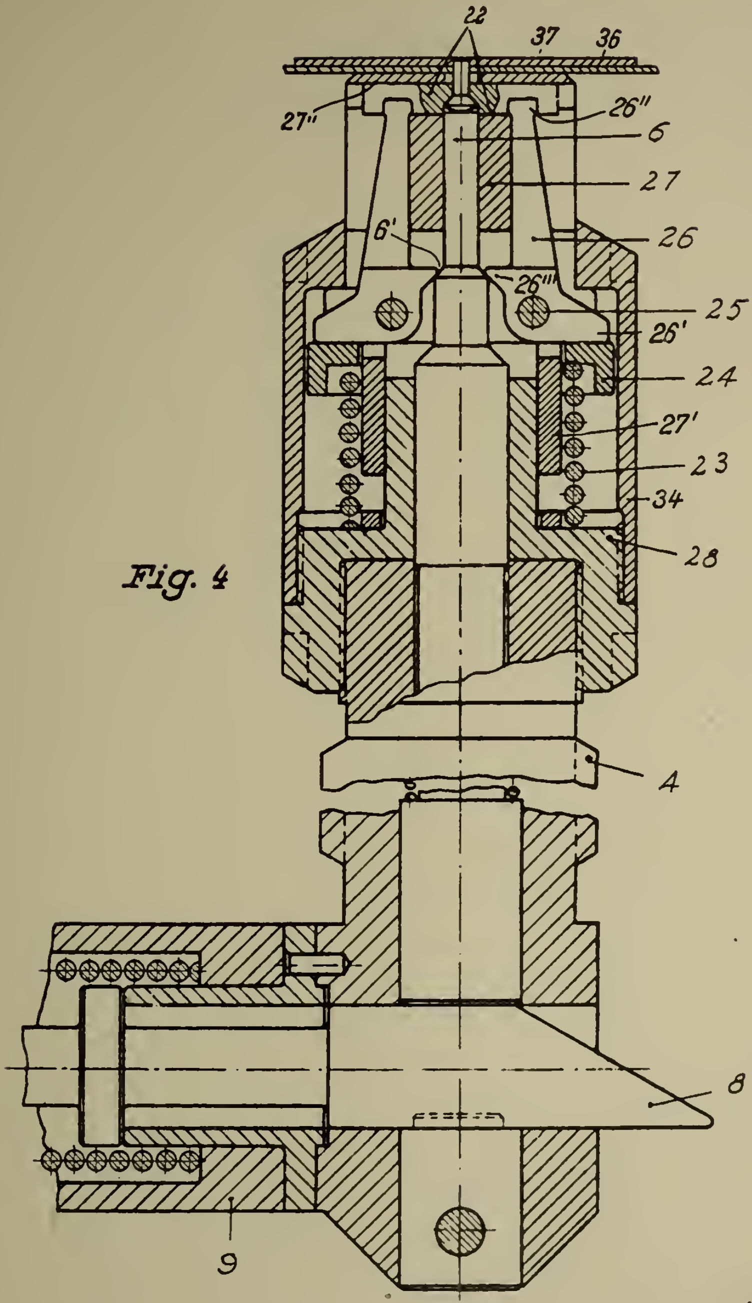

Fig. 4

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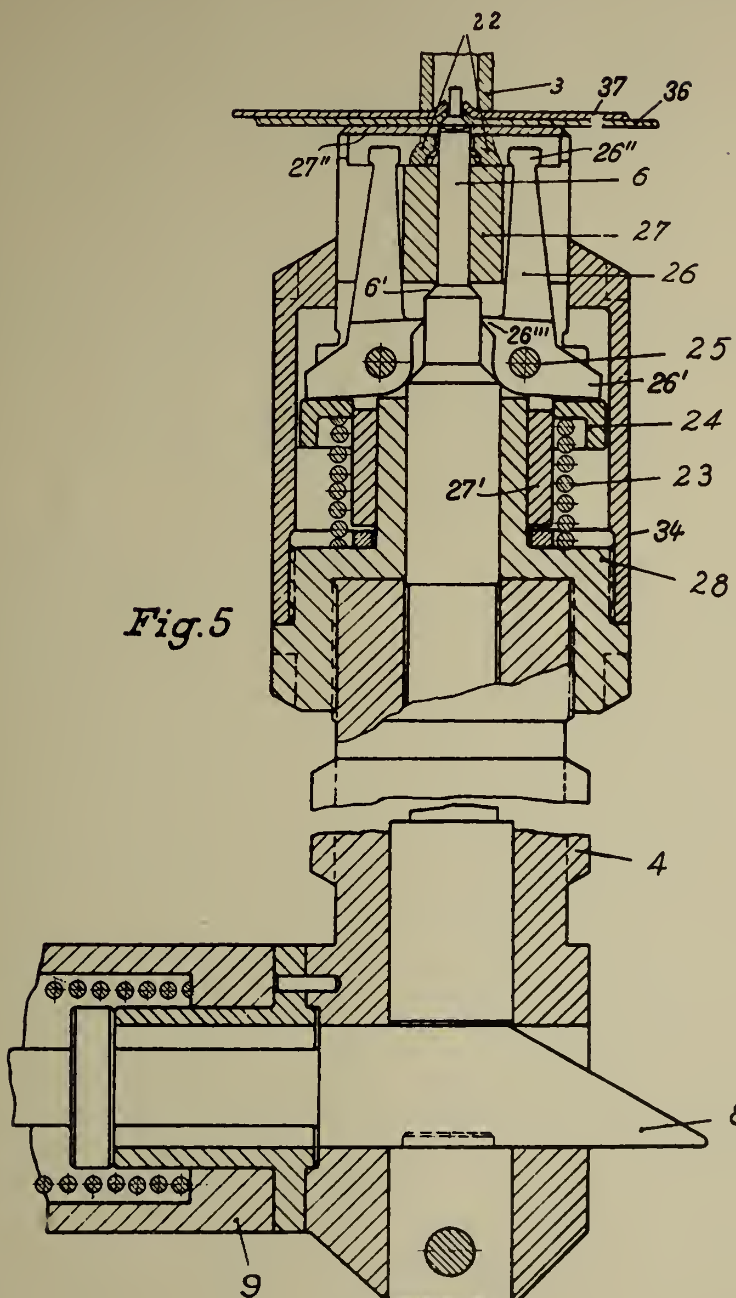

Fig.5

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Published June 1, 1943

Serial No. 378,076

ALIEN PROPERTY CUSTODIAN

METHOD OF AND DEVICE FOR ELECTRIC RESISTANCE WELDING

Gerhard Hagedorn, Berlin-Lichterfelde-West, Germany; vested in the Alien Property Custodian

Application filed February 8, 1941

The invention relates to a method for electric resistance welding characterized by the fact that for the neutralization of the electro-dynamic forces, occurring in the secondary current circuit of the welding transformer, causing the lifting off of the electrodes from the work parts, there are exerted, apart from the welding pressure, additional mechanical, pneumatic or hydraulic counter forces, starting simultaneously with the welding current and acting on the electrodes and that these counter forces are released by the time switch, the welding current or another factor connected therewith. The device for the electric resistance welding is characterized by the fact that in generating the electrode pressure by compressed air the transformer tension, the transformer current or other factors affecting the welding current, for example, the control currents of the time switch, cause increase of the pressure in the compressed air lead, starting as far as possible simultaneously with the welding current, for example, by means of an electro-magnetically operated additional plunger, or by adjusting the pressure regulating valve.

It will often be of advantage, in particular in the case of already existing plants, which as a rule do not permit of extensive rearrangements, to use for compensating the harmful forces, not electro-dynamic counter forces, but mechanical, hydraulic or pneumatic counter forces acting on the electrodes simultaneously with the starting of the welding current. Of importance is in particular that the starting takes place simultaneously, as only in that case lifting off of the electrodes from the work parts is reliably avoided. This method permits also of other possibilitles of use in practical application.

The invention is elucidated in detail in the following mode of construction. The drawing shows a plant for electrical resistance spot welding. The increase of pressure in this case is taking place, for example, by means of an electromagnet **1**, acting on the pressure reducing valve **2** by way of a lever gear and excited by the transformer current or the transformer tension. Part **3** represents a compressed air container, part **4** a two-way cock, part **5** a regulating screw, and part **7** regulation of the additional pressure by way of a stop. The time switch, controlling the welding current, may also be caused to act directly upon the pressure reducing valve.

GERHARD HAGEDORN.

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G. HAGEDORN
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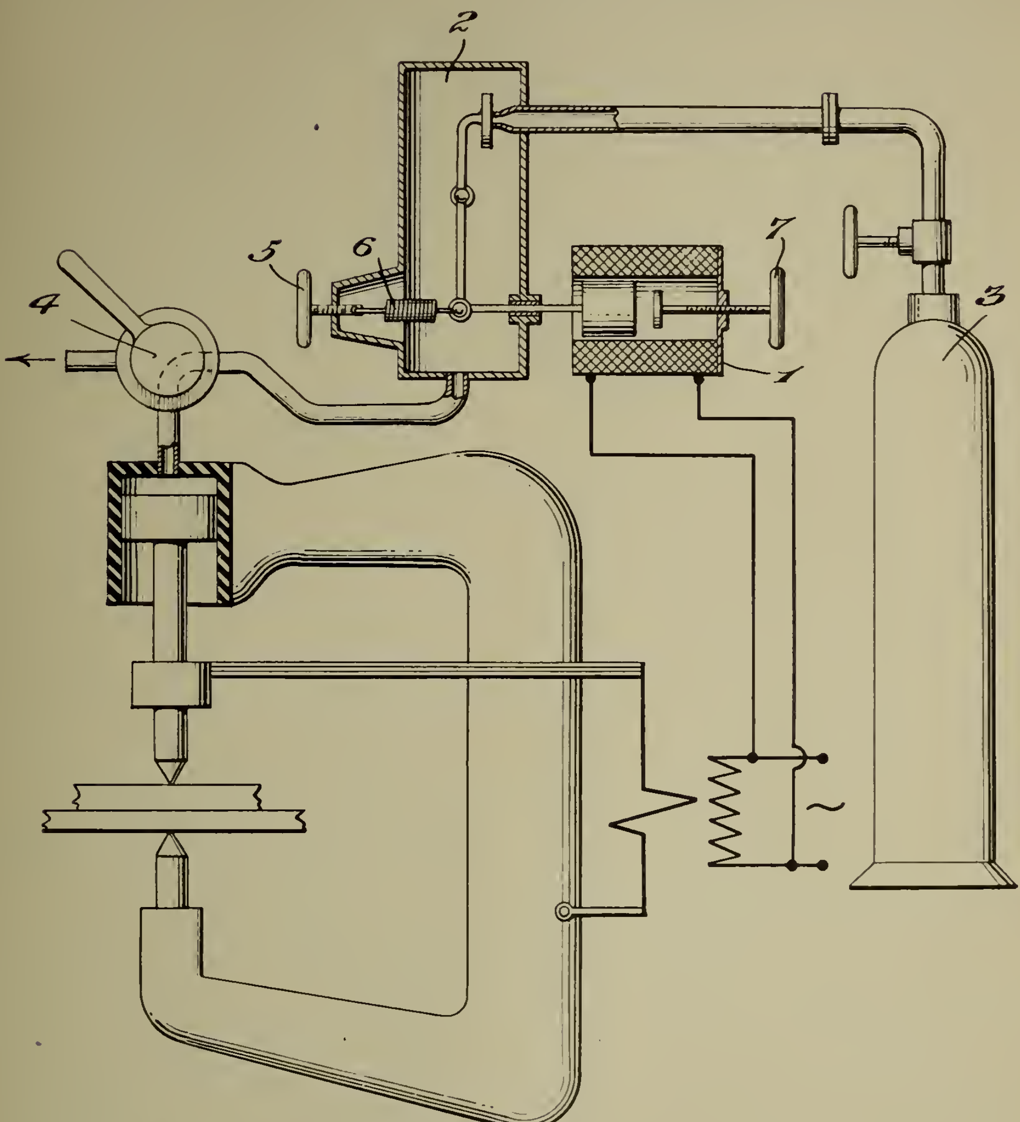

Inventor,
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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF MOULDING-MIXTURES

Richard Hessen, Bautzen, Germany; vested in the Alien Property Custodian

Application filed February 10, 1941

The invention relates to a process for the production of press-mixtures particularly those containing hardenable synthetic resins, for example products of condensation of phenolformaldehyde.

For the production of press-mixtures i. e. impregnated mixtures of synthetic substances, particularly hardenable synthetic substances such as products of condensation of phenolformaldehyde and filling substances as e. g. wood meal and occasionally additional substances such as pigments, lubricants, catalyzers and the like, four different kinds of apparatus have been proposed, to wit the mixing device in which the filling substances are impregnated with solutions of resin and further the heated kneading apparatus, the heated mixing roller and the heated mixing nozzle.

The first-mentioned apparatus is disadvantageous in that it requires, subsequent to the impregnation of the filling substance with solutions of resin, a cumbrous and difficultly controllable drying process in a vacuum or in ordinary drying kilns. This involves the risk of attaining the hardened condition of the resins before the solvent has been completely eliminated.

On the other hand the two further mentioned apparatus have the advantage that their operation does not require the use of a solvent, but even these apparatus, like the first-mentioned one, permit of discontinuous operation only, that is to say they can only be worked with separate charges, which has the disadvantage that such charges can never be completely equal to one another.

When using heated kneading apparatus, moreover, the kneading pressure is comparatively low on account of the giving way of the mass rendered plastic by heat. The water of condensation and the volatile substances cannot escape, so that the kneaded mass has usually to be subjected to an additional rolling process. For the rest such apparatus can only be operated at comparatively low temperatures as otherwise the material contacting the heated surfaces of the kneader may pass into the final condition before the remaining portions of the mass are impregnated. As a result of the use of comparatively low temperatures the process, therefore, takes much time and is disadvantageous in that the resins employed, at these temperatures are not in the best condition for impregnating purposes.

Even the most frequently used apparatus, to wit the heated mixing-roller has the disadvantage that it permits of intermittent i. e. chargewise operation only.

In that case solid resins are also used and the temperatures may lie higher. There also occurs elimination of water during the impregnation process.

The use of this apparatus, however, has the disadvantage that during the rotation of the kneading rollers, the kneading process can take place along the line of contact of such rollers only and the pressures, which may thus be attained along such line of contact, are very low on account of the giving way of the plastic material. The individual particles of the mass, when using such apparatus, during the greatest portion of the time lie in unmixed condition one beside the other and only at one moment during a revolution of the rollers, mixing will take place. During the remaining time the mass is heated in unmixed condition to high temperatures and proceeds to condense in so far the particles are in contact with the surfaces of the rollers. The remaining particles insulated by the mass itself from the roller surface, are subjected to heat to a lesser degree, so that as the rolling process lasts a few minutes only, the mass eventually obtained, will contain unevenly condensed particles.

As previously stated, all these prior apparatus have the disadvantage that they permit of discontinuous operation only. They, moreover, require comparatively much manual labour, whilst particularly in the case of kneading apparatus, the difficulty arises that during the cooling of the charges containing hardenable resins, the reaction continues even after the termination of the mixing process, i. e. during the slow cooling, thereby increasing the unevenness of the individual charges still further.

A further known device, the mixing nozzle (German Patent Specifications No. 616,178 and No. 635,227) as compared with the apparatus thus far described, has the advantage that it permits of continuous operation.

In that case comparatively high temperatures are permissible, but the capacities when using narrow mixing slots are small, whereas when using wider slots the mixing operation inter alia leaves much to be desired.

According to the present invention a novel process is proposed which runs continuously and automatically and guarantees a perfectly even and very thorough mixing or impregnation, at the same time permitting the use of comparatively high temperatures at which the resin is fluid or thinly liquid without there being any risk of undesired hardening.

According to the present invention resins and filling substances in preheated, compressed condition are laterally fed to an annular space formed between a roller and a casing or shell surrounding same. Casing and roller rotate relatively, i. e. both elements may rotate or one of them, say the casing, may be stationary. Within this annular space the mass of resin and filling substance and occasionally additional substances, is mixed and impregnated whilst being heated, the mixture being subsequently discharged from said space in lateral direction.

It is of considerable advantage to combine the

preheating and compressing operation with the mixing or impregnating process proper, in one and the same device, by feeding the resin and filling substance by means of a worm-screw which is preferably connected to the roller and in which the preheating and compression takes place.

In the case of the process according to the invention there is effected within the annular space a very thorough mixing or impregnation at the high temperature prevailing therein, due to the mass passing through this space along a helical path. There also occurs a considerable friction further advancing the thorough mixing or impregnation of the mass fed into said space in preheated and compressed condition.

The path to be traversed by the mass may still be lengthened and the mixing still further improved by providing the inner or outer element or both elements with ribs or grooves extending in axial direction, although not necessarily over the entire length of said rollers. Such ribs or grooves may also be arranged at an angle with the axis of the element or elements, however, not at an angle of 90°. By providing such ribs or grooves the passage to be traversed by the mass takes the form of a flat spiral whereby its length is increased, thus improving the mixing and impregnating process.

In its simplest form the process according to the invention may be carried into effect by using a roller surrounded by a concentrically arranged stationary shell or casing. Both this casing and roller are heated and may be provided with ribs or grooves. The annular space between said roller and shell being continuously supplied from one side with the mass to be treated, there is no risk of the mass being caked by the rotation of the roller but on the other hand a thorough mixing is effected.

Such device is preferably connected to a pressure-wormscrew for feeding the material towards the annular space, means being preferably provided for preheating and compressing the mass during such feed. The pressure-screw is preferably cooled at its loading end and is heated at the remaining parts, whilst in addition thereto the walls surrounding such screw may be heated. This feed screw is preferably connected to the rotating roller and at this location a particularly high temperature is effected e. g. by internal heating of the roller and additional electrical heating of the casing or shell which is preferably formed integral with the casing of the feed screw.

The annular space between the inner roller and the casing or shell need not have cylindrical faces, but may be contracted or enlarged towards the discharge end, e. g. by conical formation of the inner surface of the casing and cylindrical or conical formation of the roller. Alternatively the casing may be cylindrical and the roller conical.

The apparatus may also be constructed so, that rollers of different profiles may be readily inserted therein. For example an axis may be provided on which hollow rollers of varying diameters, varying cross-sectional shapes or formed with differently shaped surfaces may be placed. It is also possible to obtain the same exchangeability for the casing or shell by inserting differently shaped rings into a holding member.

As compared with the known mixing roller the advantage is obtained that the pressure of the two co-operating surfaces upon the mass enclosed therebetween, is not exerted along a line only, but practically over the entire circumference, i. e. during the entire revolution of the element or elements. Moreover, the advantage is obtained that the mass may be heated to comparatively high temperatures so that e. g. synthetic resin may be transferred to fluid state, thereby greatly facilitating the impregnation of the filling substances. Each particle of the mass within the annular space of the apparatus according to the invention, is subjected to a long lasting high pressure, accompanied with large relative movement of the individual particles and that, as long as the mass remains within the mixing space. This duration may be exactly controlled and remains unaltered during the operation of the device so that the risk of unevenness of the mixture does not exist.

As stated above, in the case of hardenable resins a process of condensation takes place during the heating, at which volatile substances, such as e. g. water and ammonia are liberated. These substances remain within the mass as long as same is under the pressure within the annular space. They escape at the same time that the mass, while expanding, leaves the annular space. This sudden evaporation is frequently of advantage, in that it effects a comparatively rapid cooling of the hot mass.

Moreover the advantage is obtained that not only a continuous but also an automatic operation is rendered possible. The initial mixture may be fed continuously, whilst the finished mixture may be collected on a conveyor device whereby it is conveyed e. g. to a grinding apparatus so that contrary to the hitherto known processes, the process according to the invention does not require any supervision.

The invention will be hereinafter described with reference to the accompanying drawing.

Fig. 1 shows a sectional view of the device for carrying into effect the process according to the invention.

Fig. 2 shows on an enlarged scale an essential portion of the device shown in Fig. 1.

The annular space is formed by the heated rotating roller **2** and the heated shell **5** surrounding same. Both the roller and the shell are provided with ribs **3**. The heating of the shell is effected by means of an electric heating device **4**.

To this annular space between the roller **2** and the shell **5** resin and filling substance in preheated compressed condition are fed laterally (from the right) by a pressure-wormscrew **1**, which conveys the rough mixture supplied by the funnel **6**, to the mixing device, at the same time compressing such mass on account of the formation of the threads of the feed screw. As the wall of the space containing such feed screw is heated, the material will be heated too. At the inlet end the screw is cooled. The feed screw is connected to the roller **2** and rotates therewith, whereas the shell **5** surrounding such roller is integrally formed with the wall enclosing the screw. The mixed or impregnated material which leaves the annular pressure space in lateral direction (to the left), and in which the resin is not yet in hardened condition, is collected on a conveyor band **7** and conveyed thereby to a grinding device **8**. The rotation of the roller **2** may also be rendered independent of the rotation of the feed screw, e. g. by introducing within the roller **2** a movable axis passing through the feed screw so as to impart to the roller **2** a movement independent of that of the screw.

RICHARD HESSEN.

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R. HESSEN
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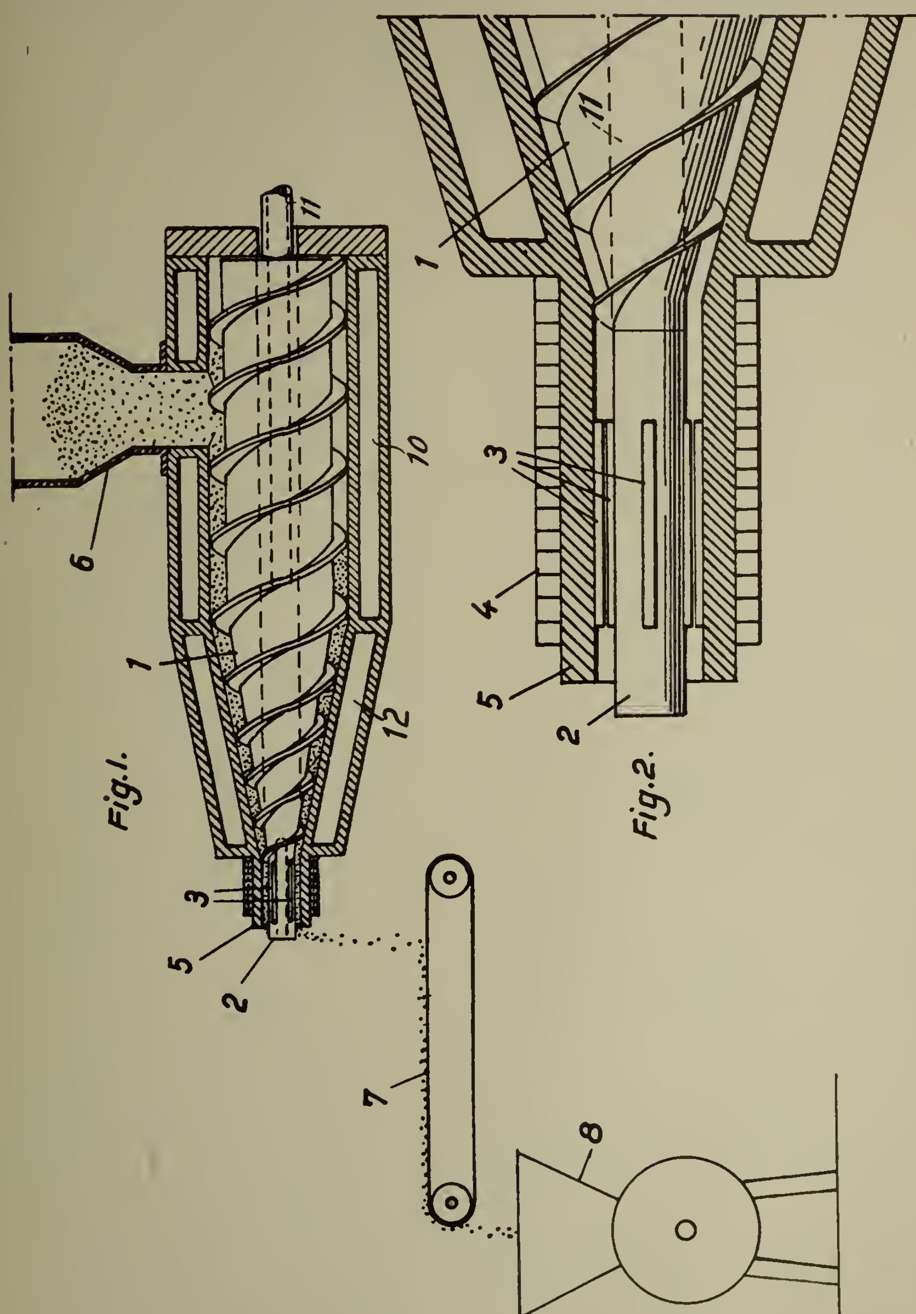

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ALIEN PROPERTY CUSTODIAN

METHOD OF AND DEVICE FOR ELECTRIC RESISTANCE WELDING

Gerhard Hagedorn, Berlin-Lichterfelde-West, Germany; vested in the Alien Property Custodian

Application filed February 11, 1941

It is known that resistance welding machines, in particular spot welding machines for light metals, carry considerable currents in the secondary circuit of the welding transformer. It has been noted, in particular in the case of light metal welding, that by these heavy currents harmful electro-dynamic forces are generated with the result that the electrodes are lifted off the work parts, though often only to a slight degree, and that at any rate the contacting pressure of the electrodes is reduced sufficient to rapidly impair the electrode area and the work parts area in consequence of the development of too intense heat of the welding current, caused by increased contact resistance. This not only endangers the corrosion-resisting quality of the welding, but also necessitates frequent replacing of the electrodes, considerably reducing the operating speed thereby. It has been endeavored to counteract such harmful forces by employing elastic means, but satisfactory results could not be obtained thereby. It has further been tried to avoid such disadvantages by making use of excessively strong contact pressures. This showed, however, that strong contact pressures entailed an extraordinary increase of the current intensity, which also had a disadvantageous effect inasmuch as the lifting off forces also showed an increase. The lifting off effect is of course diminished by the high pressure, but cannot be eliminated thereby. It is quite immaterial in this connection, whether the pressure is caused by a spring or any other pressing agent. The electro-dynamic force will continue to act, resulting in a lesser or greater acceleration of the electrode compound. These disadvantages are eliminated by the present invention.

The invention refers to a method for electrical resistance welding, characterized by the fact that for the neutralization of the electro-magnetic current forces, occurring in the secondary circuit of the welding transformer and causing the lifting off of the electrodes from the work parts, there are simultaneously generated additional electro-magnetic forces acting in the direction of the electrode pressure, compensating or overcompensating the lifting off forces. The additional electro-dynamic forces are advantageously generated by the secondary current of the welding transformer itself. But the additional electro-dynamic forces may also be generated by the primary current of the welding transformer or the source of the welding current. If the electro-dynamic forces are to be generated by the secondary current itself, the electrodes are advantageously arranged in such a manner that the electro-dynamic forces occurring in welding will press the electrodes to the work parts. In that case the elastic electrode holders, with reference to the secondary current loop, are preferably arranged obliquely toward the inside. With double-spot welding the electrode holders are also arranged obliquely toward the inside, and slidably supported at their free ends. In the case of single-spot welding an advantageous arrangement will also consist of connecting one of the electrodes with the movable part of an electro-magnet which might be fed by the current source of the welding transformer.

In the drawing the invention is represented by three modes of construction showing by

Figures 1 and 2 the distribution of the electro-dynamic forces with known welding devices for single-spot and double-spot welding,

Figure 3 a single-spot welding device with compensation of the electro-dynamic forces in the secondary circuit of the welding transformer according to the invention,

Figure 4 a double-spot welding device with compensation arrangement according to the invention and

Figure 5 a further single-spot welding device with compensation arrangement according to the invention.

With the known single-spot welding device according to Figure 1, where the electrodes are contacted by the pressure P, the electro-dynamic forces 1, 2, 3, 4, causing the lifting off of the electrode from the work parts 5, 6 and pressing them toward the outside, are indicated by arrows.

In Figure 2 are shown in a known double-spot welding device the electro-dynamic forces 7, 8, 9, effecting the lifting off of the welding electrodes, contacted by the pressure P, from the work parts 5, 6.

Figure 3 represents a single-spot welding device in which the additional electro-dynamic forces 10, 11 are generated by the secondary current of the welding transformer itself, said forces counteracting the lifting off forces 12, 13 and increasing the welding pressure P at the moment of the current impulse. The electrodes in this case are arranged in such a manner that the electro-dynamic forces, occurring in the welding operation, press the electrodes to the work parts 5, 6, this being effected, for example, by having the elastic electrode holders 14, 15, referring to the secondary current loop, arranged obliquely toward the inside.

Figure 4 represents a double-spot welding device where the additional electro-dynamic forces 16, 17 are also generated by the secondary current of the welding transformer itself, said forces counteracting the lifting off forces 18 and increasing the welding pressure at the moment of the current impulse. The electrode holders 19, 20 in this case are arranged obliquely toward the inside and with their free ends 21, 22 are slidably supported, for example, by means of the plungers 23, 24 in such a manner that the electro-dynamic forces 16, 17 press the electrodes to the work parts 5, 6. The electrodes and the electrode holders are in this instance preferably designed as small as possible. The movement of the electrode holders 19, 20 toward the inside is checked by stops 25, 26, offering but slight frictional resistance. When moving toward the outside they may rotate around a pin of the compressed air plunger sliding in the compressed air cylinders 27, 28, the contacting pressure being generated by the said compressed air plunger. Hence, they may yield to the action of the electro-dynamic forces and firmly press upon the work parts.

Figure 5 represents a further single-spot welding device with compensation of the lifting off forces. Upon the upper electrode holder 29 acts, in addition to the compressed air plunger, an electro-magnet, for example, with movable iron core 31 and rigid coil 32, whose excitation may originate from the welding current source during the time of flow of the welding current. The coil 32 of the electro-magnet is fed by way of the leads 33, 34. With this device it will be possible to compensate or overcompensate the lifting off forces.

GERHARD HAGEDORN.

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2 Sheets-Sheet 1

Fig. 1.

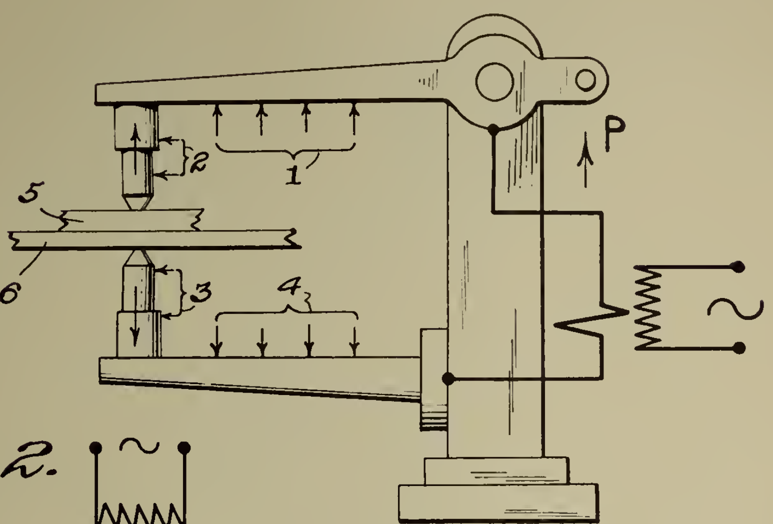


Fig. 2.

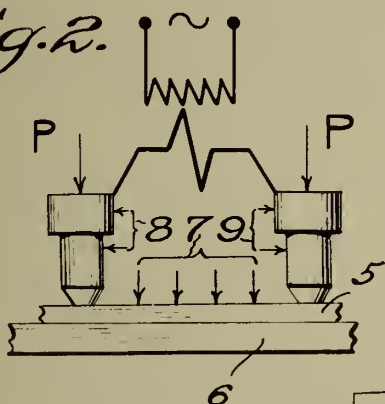
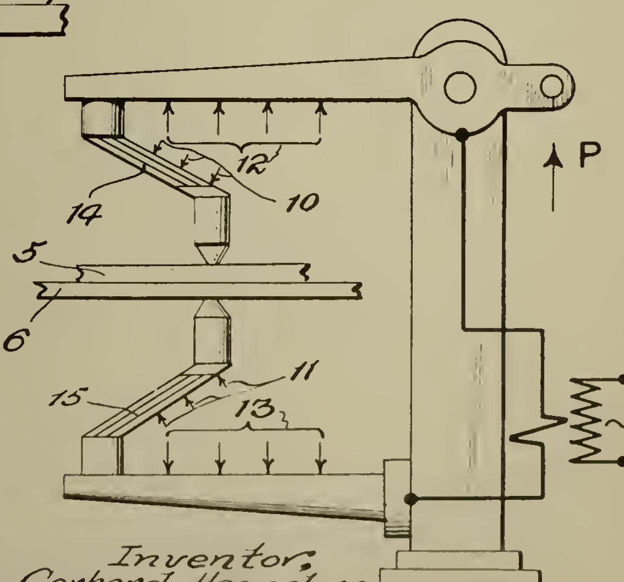


Fig. 3.



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2 Sheets-Sheet 2

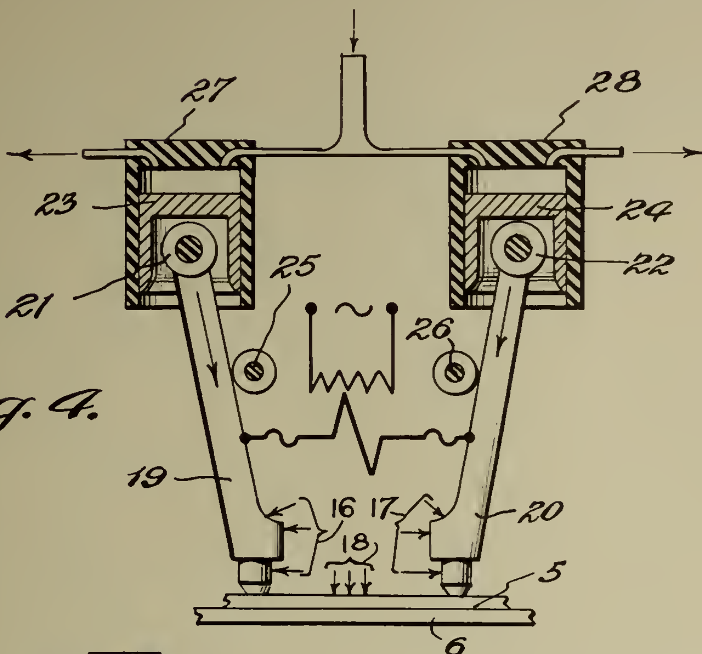

Fig. 4.

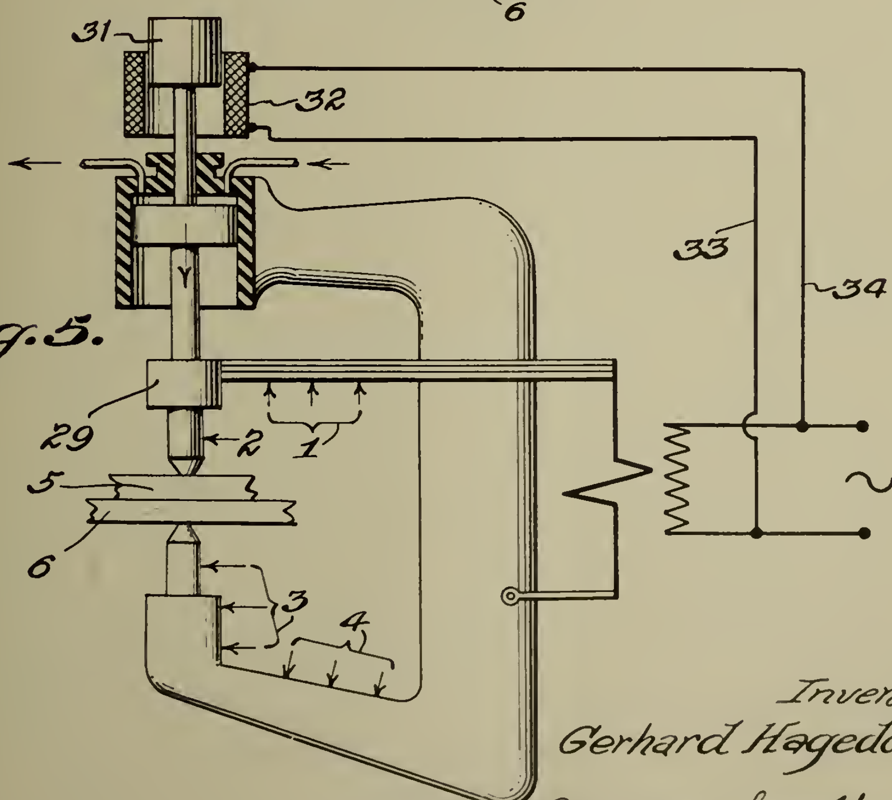

Fig. 5.

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ALIEN PROPERTY CUSTODIAN

METHODS OF MANUFACTURING ELECTRON TUBES

Franz Lohmann, Hamburg, Germany; vested in the Alien Property Custodian

Application filed March 1, 1941

This invention relates to the manufacture of discs or cups made of pressed glass and carrying electric conductors in order to serve as the bottom of electron tubes, these conductors being the inleads thereof.

The invention aims to obviate certain disadvantages of the prior methods of manufacturing these structures, as will be understood from the following description and the accompanying drawing, in which

Fig. 1 is a sectional view showing a structure of this kind, Fig. 2 is a partially sectioned view of a prior device used in the manufacture of such structures, Fig. 3 is a partially sectioned view illustrating one embodiment of the invention.

As shown in Fig. 1 by way of example, the structure or article to be manufactured consists of a disc A, made of pressed glass, and conductors **2** sealed into this disc. The disc A may be cup-shaped.

According to Fig. 2, the device previously used for manufacturing structures of the kind represented in Fig. 1 comprises a horizontal die **1** rotatable on its vertical axis and provided with cylindrical recesses or bores B, and a counter-die **5** that has bores C arranged to coincide with the bores B. The bores B, C are calculated to receive the conductors **2**. The glass from which the disc A is to be made is employed in the shape of a tube **3** adapted to be placed on the die **1** and to encircle the conductors **2** mounted in the recesses B. With tube **3** in this position the die **1** is set rotating while tube **3** is heated by means of a gas jet **4**. When the glass tube **3** is soft enough the die **5** is lowered so as to compress the glass body **3** and convert it into the disc A, the conductors **2** entering the bores C.

This method has the following disadvantages. The glass tube **3** when softening sinks down on the die **1** and thereby loses a great deal of its heat, this die acting to conduct the heat away from the glass **3**. As a result it is difficult, and in the case of hard glass impossible, to soften the glass body **3** uniformly. The pressing operation hence fails to be satisfactory. In addition the flame at **4** must be very hot, whereby the conductors **2** are highly oxidized. The metal oxide so produced is in part absorbed by the glass **3** and pressed into it, thus impairing the thermal and dielectric properties of the disc A.

According to the invention the dies **1**, **5** are both arranged to revolve on a horizontal axis, as will be seen in Fig. 3, and the vitreous material for making the disc A is in the shape of a ring **6** supported by conductors **2** and midway between the dies. The vitreous material is thus easier to heat and the gas jet **4** hence may be less effective than in the case of Fig. 2. The gas jet **4** is adjusted so that the dies shall not be much heated. By the dies revolving about an axis common to them the softening glass is prevented from dripping. The glass also does not contact with the dies until the pressing operation takes place. Consequently, the loss of heat of the glass is less than in the case of Fig. 2. Furthermore, the expenditure in heat being less than in the case of Fig. 2 the conductors **2** are less liable to oxidize and thereby to deteriorate the glass from which the disc A is to be made. Moreover, as the conductors **2** are located at their ends in the dies **1**, **5** they are cooled by the dies, which thus in their turn aim to prevent the conductors from oxidizing.

For using the pressing dies **1**, **5** shown in Fig. 3 the conductors **2** are mounted in the recesses B of die **1** and the glass ring **6** is inserted over these conductors, whereupon the die **5**, having bores C for receiving the conductors **2**, is likewise inserted over them. The structure **1**, **2**, **6**, **5** is then set rotating while at the same time the ring **6** is softened by the gas jet **4**. Die **5** is then advanced toward die **1** so that ring **6** is compressed and thus converted into the disc A into which at the same time the conductors **2** are sealed in this way.

FRANZ LOHMANN.

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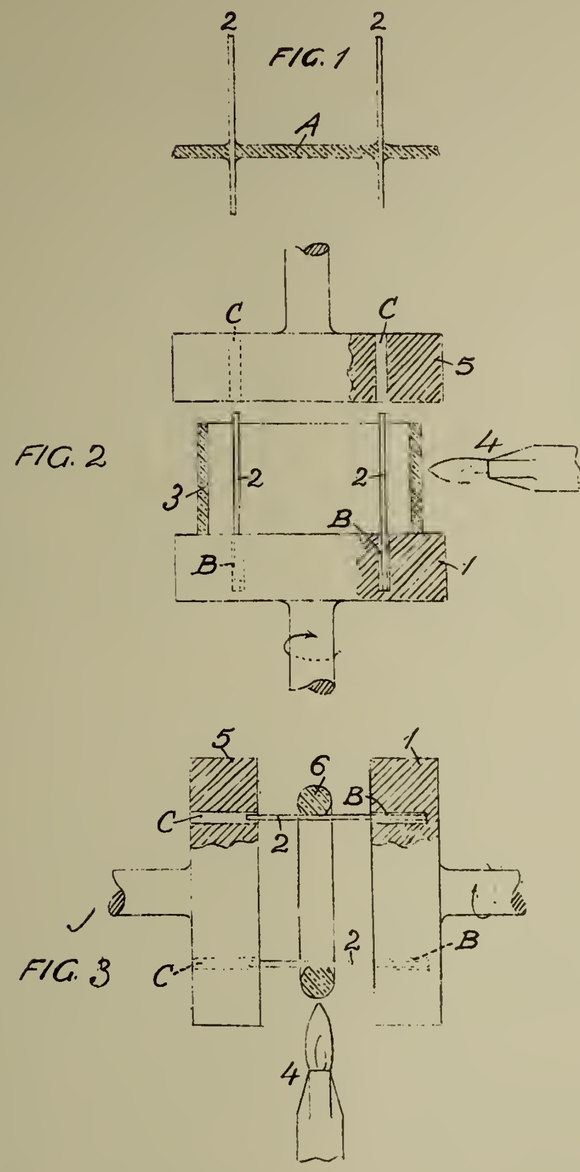

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Att'y

BY

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ALIEN PROPERTY CUSTODIAN

HIGH PRESSURE CLOSING DEVICES

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This invention relates to an improved high pressure closing device.

It is a fact well-known with high-pressure valves, particularly with those used for compressed air, and in which, in the closed state, sealing is effected by pressing metallic surfaces and edges upon each other, that they remain air-tight for a short period only, even if they be finished according to the best methods and the material be carefully selected. This is mainly due to the fact that the air passes along the seating surfaces at a very high velocity, especially when the valve cone is but slightly open, so that the sealing surfaces and edges quickly become scored by the action of solid particles, or, as experience has shown, even of water droplets, carried along by the compressed air.

To avoid this, the attempt has already been made to obtain the necessary tight sealing by seating the valve cone or disc on a somewhat softer or elastic material, such as special alloys of white metal, ebonite, cellon, and the like, and by pressing such cone or disc against such material by means of a high closing pressure. But even this method has proved unsatisfactory in the long run, because in this case the afore-mentioned scoring of the seating surfaces also takes place, quite apart from the fact that the seating surfaces finally become crushed as a consequence of their frequent and excessive compression. Most of the high pressure valves, therefore, present the disadvantage of becoming leaky in use after a certain period of service. The economic efficiency of the plant therefore suffers as a consequence of the constant loss of compressed air which in certain cases must absolutely be avoided.

Now, the construction of the device forming the subject of my invention follows a line deviating from the methods used heretofore. It consists in that, when closing the device, first a preliminary shut-off of the high-pressure line is accomplished by means of a slide valve which, on its own account and as experience has shown, does not produce a reliable seal. Furthermore, a lipped seal, e. g. a "Simmerit Grooved Ring Sleeve Packing", which, while inadequate as a direct packing for high-pressure valves yet has given highly satisfactory results with high pressure stuffing boxes, is provided at the points of leakage in question, located between the inlet and the outlet side, and is so arranged, similarly to the sealing surfaces of the preceding preliminary shut-off, as to lie outside the current of the high-pressure medium, thus eliminating damage due to the unrestrained action of said medium, and securely retaining such quantities of the leaking pressure medium, as might have penetrated thereto.

The accompanying drawings show four embodiments of the new closing device.

The embodiment according to Figs. 1 to 3 comprises a straight guided, tubular slide valve **1** closed at the bottom and having two rows of ports **2** and **3**. In Figs. 2 and 3 the same valve is represented on a larger scale. This tubular slide valve has an internal thread engaging with the thread of a spindle **9** which can be turned by a hand-wheel **4** but cannot be displaced axially. By turning the hand-wheel **4**, the tubular slide valve **1** may thus be screwed up and down in the stationary bushing **5** fitted into the three-part housing **7**. The bushing **5** has ports **6** with which the ports **3** of the tubular slide valve may be brought to coincide.

When it is intended to close the device represented in the opened state in Figs. 1 and 2, the tubular slide valve **1** is raised by turning the hand-wheel **4**. In doing so, its row of ports **3** moves away from the formerly coinciding row of ports **6** of the bushing **5**, passing the upper portion of the latter, which is not broken by openings. From this moment onwards, the current of high-pressure air which is admitted laterally through the branch of the housing **7** and escapes at the bottom end of the valve, is cut off, and only very little air is still allowed to penetrate between the bushing **5** and the periphery of the slide valve, which may be supposed to move therein with a sliding fit, as well as through the threaded connexion between the slide valve and the spindle, and thus to pass on to the outlet side. This leakage air which would escape and be lost if only the preliminary shut-off existed, is prevented from escaping according to my invention by the provision of a sleeve **10** of the grooved-ring type, encircling the tubular slide valve. This stuffing-box packing, which is in itself well-known, is fitted between the lower and the medium part of the housing **7** with a small axial play. When closing the slide valve (Fig. 3), the air pressure firmly presses the inner edge of the lips of the sleeve **10** to the outer cylindrical surface of the lower part of the slide valve, thus creating a reliable seal.

During the closing operation, i. e. while the tubular slide valve **1** is moving upward, the row of ports **2** passes through the grooved ring **10**, and care has to be taken not to injure the lip edge of the latter, as this is made of india-rubber and therefore easily damaged. For this purpose, the surface of the tubular slide valve **1** is recessed conically over its entire circumference above and

below the row of ports 2, and the edges of the ports 2 are rounded off. Furthermore, for the same reason the ports 2 are drilled in an angle to the axis, rising towards the outer side, i. e. in a direction coinciding with the position of the packing-lips. This ensures that the leakage air continuing to escape during the closing operation tends to separate the delicate lip-edge of the grooved ring from the tubular slide valve, which action also protects the grooved ring against damage.

The lower end of the tubular slide valve 1 is designed in the form of a valve cone 12 which, by turning the hand-wheel 4, can be screwed down to the seating 13 arranged in the housing. Thus, in case of emergency, the second seal between the inlet and the outlet side can also become operative at least for a short period, and the installation be kept working temporarily if, at any time, the grooved ring should exceptionally happen to fail, whereupon it will have to be replaced at the next opportunity.

Since the life of grooved-ring sleeves of such design has in numerous cases been tested and found satisfactory when applied to stuffing-boxes, their application, as described above, creates a shut-off device suitable for opening and closing, which distinguishes itself advantageously from the conventional types of valves, particularly on account of its reliability under very high pressures. It is also suitable for special conditions where the time allowable for repairs is frequently short, and only simple auxiliary means can be resorted to.

The second embodiment illustrated in Figs. 4 and 5 also comprises the straight guided tubular slide valve 1 which is provided with an internal thread and can be screwed up and down by means of the hand-wheel 4. With the slide valve 1 fully open (Fig. 4), the compressed air coming from the container—in this case from below—flows through the stationary bushing 5, which projects into the tubular slide valve 1, and passes out laterally through the openings 2 to the place of consumption. On screwing down the tubular slide valve 1, the bushing 5 covers the range of holes 2, constituting a preliminary shut-off of the current of compressed air (Fig. 5). Any leakage air escaping from between the tubular slide valve 1 and the bushing 5 as well as through the thread of said valve, thus putting the housing under internal pressure, is prevented from reaching the space in direct communication with the outlet pipe by the grooved ring 10 sealing below, and by a second grooved ring 11 sealing above said space. In this case the compressed air once again presses the edges of the lips of the grooved rings tightly against the outer surface of the tubular slide valve 1, sealing said surface. In the examples according to Fig. 1 to 5, the tubular slide valves 1 have lugs 8 guided in grooves 15 cut in the cap 16 of the housing 7, which lugs 8 serve to prevent turning the tubular slide valve 1 during its vertical movement.

The arrangement adopted for preventing damage to the grooved ring 10 during the passage of the row of ports 2 is similar to that of the first embodiment.

In the third embodiment, illustrated in Figs. 6 and 7, the current once more follows the direction shown in the example first described, namely from top to bottom. The slide valve serving as a preliminary shut-off of the compressed air, is however of a somewhat different design as it has a piston-shaped part 14 fitted with two grooved rings 10 and 11, the lips of which face each other, while its lower end is fitted with a short tubular part 1, open at the bottom and provided with ports 2. In addition, this example differs from the two others in that the slide valve, on turning the hand-wheel 4, rotates with the spindle 9 which, in turn, engages with the thread of the housing 7, in which it moves up and down.

When the device is open (Fig. 6), the compressed air can flow from the cylinder to the place of consumption, passing through the ports 6 of the stationary bushing 5 and the ports 2 of the tubular slide valve 1. On screwing down the piston 14, the non-perforated wall located in the lower part of the bushing 5 provides a preliminary shut-off for the ports 2. In this final position of the slide valve, the grooved rings 10 and 11 are situated on both sides of the ports 6 of the bushing 5. Consequently, when the compressed air has reached the piston 14 it cannot escape either towards the top or the bottom of the valve, as the air firmly presses the outer lips of the grooved rings against the inner wall of the bushing 5, thus ensuring an entirely reliable seal.

The application of a like arrangement ensuring particular and reliable cooperation between the slide valve and the grooved ring packing, is also possible in connection with automatic valves. Thus, as the fourth embodiment, Figs. 8 and 9 show a safety valve, the reference numbers of which correspond, in part, to those of the embodiments already described. In the housing 7 is mounted a slide valve 17 designed as a hollow differential piston, which on both sides of its shoulder 18 and within range of the smaller and greater diameters is provided each with a series of slots 19, 20 and surrounded each by an elastic grooved ring 10, 11. Communicating with an annular space 21, encircling the slide valve 17, is on the one side the connecting branch 22 of the pressure line, and on the other a bore 23 the wall of which in the opposite direction tapers down to edge-like form. Between the latter and an identical edge located a certain distance apart therefrom, but in opposite direction, of a coaxial bore 24 open to the atmosphere, there is a membrane 25 which by the action of a tensioned spring 26 lies against the edge of the bore 23. Extending to the outer end of the bore receiving the greater step of the slide valve 17, and arranged thereon, is a longitudinal groove 27 connected with a bore 28 bifurcating one each branch to either side of the membrane 25.

So long as the pressure to be controlled in the respective container, tube or the like remains at normal height or below the admissible limit, the membrane 25, according to Fig. 8, seals the bore 23. At the same time, the greater face of the slide valve 17 is relieved by the communication of the groove 27 with the atmosphere, so that the slide valve 17 is subjected to the action of the pressure medium at its shoulder 18 only and is thereby held in closed position.

As, however, the pressure on the valve becomes excessive, the membrane 25, against the action of the adjustably loaded spring 26, is brought into the position according to Fig. 9, in which the groove 27 is shut off from the bore 24 open to the atmosphere, and is, in exchange, connected with the bore 23 being under pressure. The pressure medium now can also impinge upon the greater face of the slide valve 17, pushing the same to the left into its opened position, in which the annular shoulder serves as a stop for limiting the stroke. At this point, however, the slide valve

17 will only remain until the pressure of the medium, owing to its issuing into the atmosphere by way of the slots 20, 19, has decreased to an amount somewhat below the admissible maximum limit. The preponderance of the spring load acting upon the membrane 25 then re-establishes the state shown in Fig. 8. The faces arranged in the interior of the slide valve 17 are acted upon by the pressure medium with equal force in opposite directions.

Inversely, a valve of this character may also be used in closing a normally open connection, when the pressure falls below an admissible lower limit. In such a case, the valve only seals upon the occurrence of an undesired working condition. It may then in certain circumstances be useful in the design of the slots in the slide valve to take cognisance of the necessity of adapting the throttling effect due to the passage of the air through the slide valve, to the conditions prevailing in each case. Furthermore, an arrangement of substantially similar character may likewise be used in automatic closing and automatic opening, upon surpassing, or falling below, a predetermined pressure. It is only necessary to this effect to modify the arrangement of the slots, bores, etc. in a suitable manner. Finally, in order to protect the inner sealing lips of the two grooved rings, similar measures may be taken as in the case of the other embodiments.

The combination of a main and an auxiliary regulating member, of which the latter only is spring-pressed, is well-known in itself with other types of valves. The advantage it offers and which resides in the fact that the opening and the closing movements of the main regulating member, which movements should be accomplished at the critical moment with the greatest possible celerity, are not restrained by an increasing spring tension, still enhances the suitability of the present device. But even if for some reason or other, for example in order to avoid the stepped arrangement of the slide valve, its normal position is more conveniently maintained or re-established by a tensioned spring rather than by the pressure medium acting upon its shoulder, this object is achievable by means of a relatively weak spring which only need overcome the frictional resistance due to the displacement of the slide valve, but no counter-pressure.

The above described four embodiments of the novel closing device are therefore in conformity with each other in that, when closing, a preliminary shut-off is first accomplished by means of a slide valve, and that subsequently thereto a final shut-off of the compressed air having an action similar to that of a stuffing-box is obtained by using grooved rings known in themselves (for example in the nature of the well-known "Simmerit Grooved Ring Sleeve Packing"). All the elements are so arranged that the surfaces and/or parts contributing to effect tightness, lie outside the main path followed by the pressure medium. Provisions are also made to prevent the delicate edge of the lips of the grooved rings from being damaged on passing the ports.

KARL WERNER.

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JUNE 1, 1943.	HIGH PRESSURE CLOSING DEVICES	381,815
BY A. P. C.	Filed March 5, 1941	4 Sheets-Sheet 1

Fig. 3.

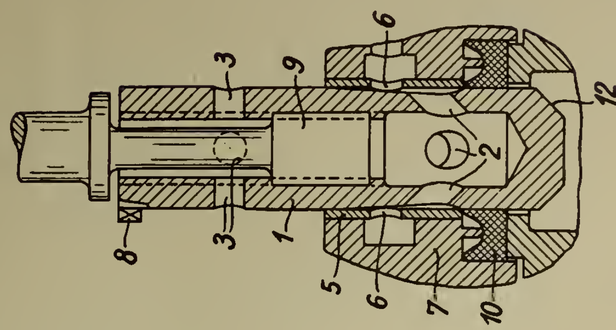


Fig. 2.

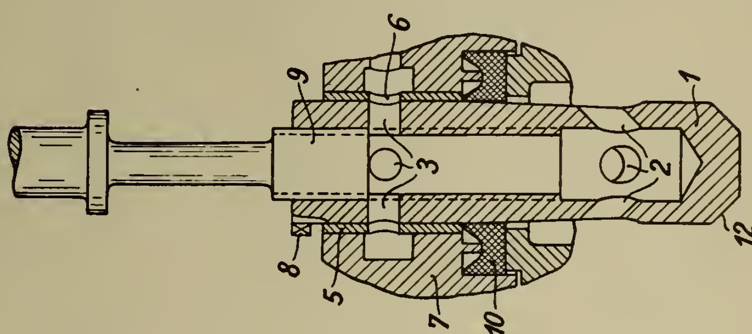
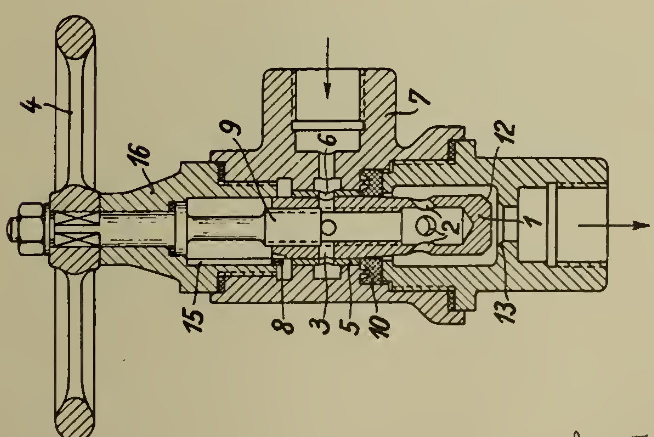


Fig. 1.



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K. WERNER

HIGH PRESSURE CLOSING DEVICES

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Serial No.

381,815

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Fig. 5.

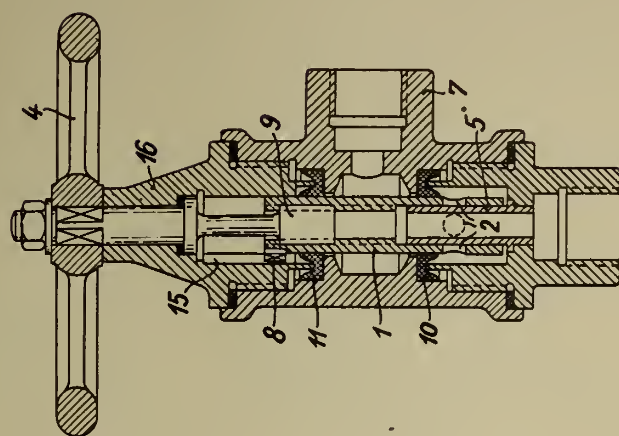

Fig. 4.

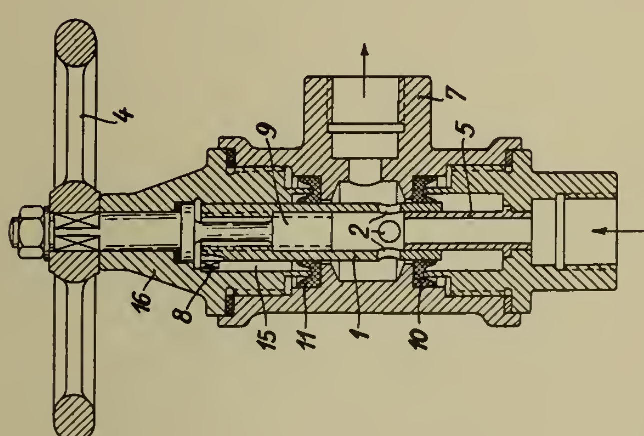

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Fig. 7.

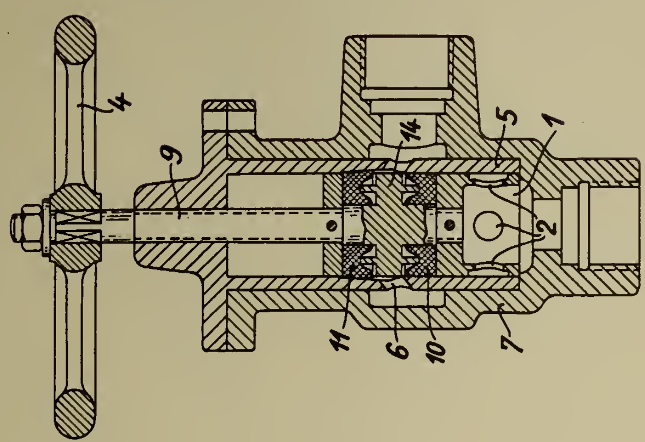

Fig. 6.

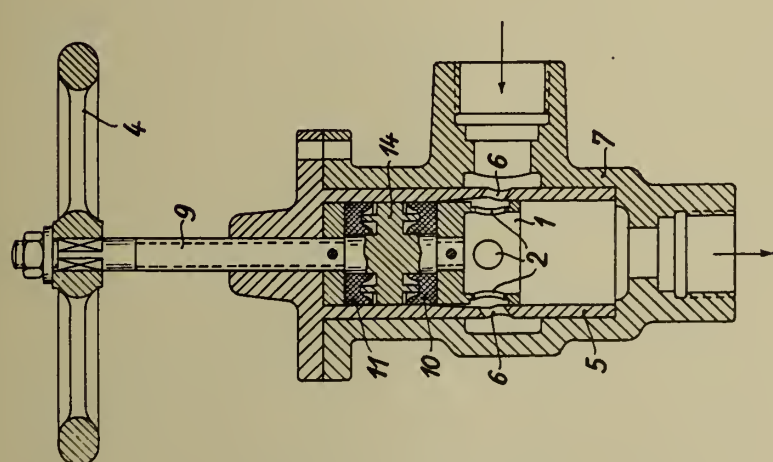

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Fig. 8.

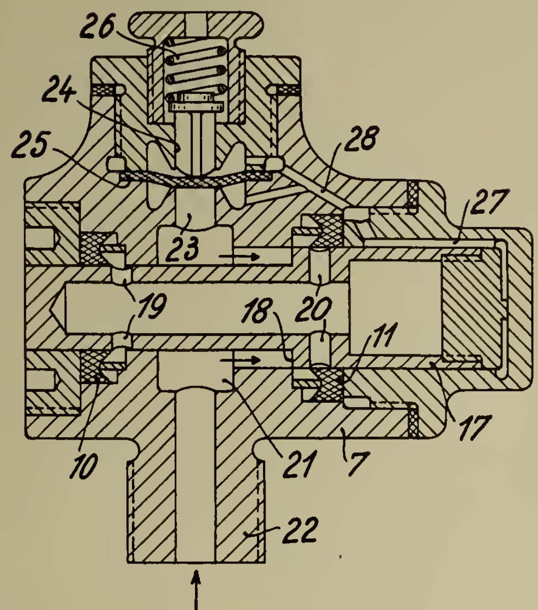
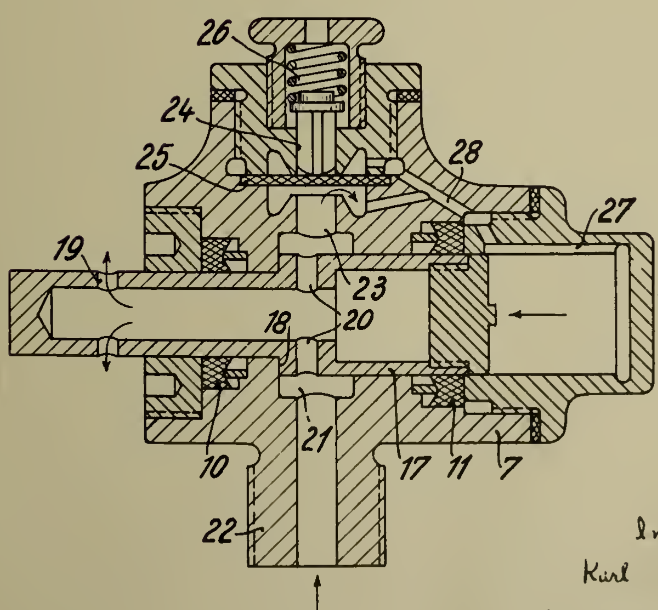


Fig. 9.



Inventor
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Published June 1, 1943 Serial No. 381,944

ALIEN PROPERTY CUSTODIAN

CROSS WINDING FRAME

Wilhelm Reiners, Munchen-Gladbach, and Gustav Kahlisch, Rheydt, Germany; vested in the Alien Property Custodian

Application filed March 6, 1941

According to the patent application in USA, Serial No. 326,641, a cross winding frame with automatic replacing of the winding bobbins and automatic yarn connection is further developed in the direction that to each winding point a yarn knotting device and a sleeve magazine are coordinated so that at any usual spindle subdivision of the winding frame the winding work in the individual winding points can automatically progress, independent on the proceedings in the neighbouring winding points. The sleeve-magazines are arranged on carriages shiftable in the circulating plane of the rotary star, so that the actually lowermost bobbin of the magazine is pushed onto one of the mandrels of the star in the rhythm of the revolving movement of the star.

In winding machines according to this patent application in USA, Serial No. 326,641, the reserve of the winding bobbin heads is obtained thereby that the magazines are filled by hand.

In order to further simplify the attendance of the frame, the feeding of reserve is carried out according to the invention in a manner known as such by means of a common magazine and lap lattice, in that from the conveying cradles of the lattice, by means of grippers coordinated to each winding bobbin head or by means of the magazines provided according to the patent application in USA, Ser. No. 326,641 but accordingly altered, winding bobbins are automatically taken when necessary, in that the grippers during the continued running of the lattice, are oscillated from out of the range of the conveying cradles, or the locking devices holding the bobbins in their cradles are released when passing along the magazines. When grippers are employed, the bobbins are pushed by means of a pushing device from out of the gripper onto the mandrels, and bobbins not taken from the lattice are ensured against slipping out of their conveying cradles at the reversing points of the lap lattice similar as according to a former proposition. If, however, separate magazines for more than one bobbin are employed in the individual winding bobbin heads the inlet slot of each winding bobbin magazine is displaced, according to the invention, relative to the delivering point of the magazine, so that the stroke of the magazine carriage for shifting the winding bobbin on a mandrel of the rotary star remains unaltered, the rotation of the star, however takes place outside the range of the lap lattice. The invention further provides, as a separate space-saving arrangement of the lap lattice, in that the magazines of the winding bobbin heads and the common magazine for the automatic supplying of the lap lattice are situated within the space around which the lap lattice circulates.

Several embodiments of the invention are illustrated by way of example in the accompanying drawing. Working elements having the same effect are designated by similar reference numerals.

Figs. 1 and 2 of the drawing show the coordination of a common bobbin magazine and lap lattice for all winding points of a winding frame together with grippers holding in reserve each one a bobbin for the rotary star of each winding bobbin head in front and side elevation.

Figs. 3 and 4 show in front and side elevation the coordination of a common bobbin magazine and lap lattice for single magazines existing in the several winding bobbin heads,

Fig. 5 shows in front elevation a special construction according to Figs. 3 and 4.

At each winding point the arrangement for the replacement of bobbins is placed under the driving force of a shaft **2** in the rhythm with the change of the winding bobbins and the building up of the cross wound bobbin by means of a coupling **27**, **28** and toothed wheels **36**, **37**, as explained in detail in the USA patent application Serial No. 326,641. When the thread reserve of the actually unwinding bobbin K is exhausted, the contact levers **39**, **40** close a control current whereby through the relay **38** the rod **32** and the lever arm **31** the coupling element **28** is connected with the toothed wheel **36** by means of a coupling bolt. The rotary star **21** is then turned by revolution of shaft **26** by a pin **41** striking against the lowermost star mandrel **22**, whereby the foot of the empty sleeve H (Fig. 4) is shifted by the stationary stripper **23** from its mandrel **22** and the lap lattice **25** is thrown out.

In the example shown in Figs. 1 and 2 a lap lattice **201** circulates in front of the winding bobbin heads over driving and guiding wheels **202**. Every second chain link **203** is constructed double to form a conveying cradle **204** which carries forwardly directed noses **205** on the end which is the front end in the running direction. Each conveying cradle **204** is further equipped with locking levers the upper parts **206** of which engage over the inserted bobbin as soon as the lower arm **207**, when running into the reversing point of the lap lattice **201** at the right hand shown in the example in Fig. 1, strikes against a pin **210**. If an empty cradle **204** of the lap lattice **201** moves under the magazine **208** the actually lowermost bobbin K, prevented by tongues **209**

from slipping out, is pushed out by the noses **205** in the cavity, whereas when the cradle is still filled the content of the magazine is correspondingly pressed upwards and thereby liberates the path. The next bobbin K not carried along slides over the rounded rear wall of the cradle down onto the tongues **209**. In front of each winding bobbin head a bobbin gripper **214** is arranged in arms **213** pivotable about a shaft **211**, said bobbin gripper being pressed by a spring **215** into the path of the lap lattice **201** as soon as a locking nose **217** fixed on an arm **216** is liberated by a pin **218** under the action of a stop **219** controlled at the bobbin changing. The conveying cradle **204** therefore hands over its bobbin, when the movement continues, to the downwardly oscillated gripper **214** and then presses the same upwards by means of the noses **243**, **244**, so that the locking lever **217**, **218** engages. The bobbin is thus brought into the axis of the mandrels **22** directed in the example shown in Fig. 2 towards the left or towards the right. A ratchet wheel **224** is then rotated through the intermediary of a chain drive **220**, a crank **221** and a rod **222**, also influenced by the shaft **26**, by the control nose **226** hinged on the lever **225**, said ratchet wheel turning about a shaft **223**, said control nose **226** up to the moment having been held out of engagement with the ratchet wheel **224** by the inclined surface **227** and the pin **228**. At the rotation a long arm **229** is moved in opposition to the action of a spring towards the winding bobbin head and thereby the reserve bobbin is shifted onto the mandrel **22** of the star by means of a stop **231** guided on a rod **230** as shown in Fig. 2 on the left hand half.

In the embodiment illustrated in Figs. 3 to 5 the pushing on of the reserve bobbin is effected as according to the USA patent application, Serial No. 326,641 by the magazine carriage carrying the magazine **24** and moved by a crank drive on the control rod **44**.

The inlet slot of each magazine **24** is displaced relative to the pushing out opening so much, that it is run-over by the conveying cradles **204**, but not displaced farther from the winding bobbin head than the free circulating of the rotary star requires at the putting on of a reserve bobbin. The bobbins are securely held in this form of construction also in the straight portion of the path along which the lap lattice moves. When passing along the magazines **24** the locking arms **206** are oscillated back against the action of the springs acting on them so that the bobbin can sink into the magazine **24** as long as the magazine is not completely filled. When the magazine is filled, however, the bobbin continues to roll and gets onto a guide plate **240** mounted on the guide slot which guide plate presses the bobbin again into the conveying cradle until the locking arms grip over it again. In the edge of a magazine an indentation **241** may be provided and also a small transverse bar **242** as shown in Fig. 4 which enables the closing position of the locking arms **206** as long as a magazine is not exactly within the range of the conveying cradle owing to the shifting-on movement.

The special construction shown in Fig. 5 shows the space-saving arrangement of all single magazines **24** and of the main magazine **208** in the space around which the lap lattice circulates.

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PUBLISHED

JUNE 1, 1943.

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W. REINERS ET AL

CROSS WINDING FRAME

Filed March 6, 1941

Serial No.

381,944

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Fig. 1.

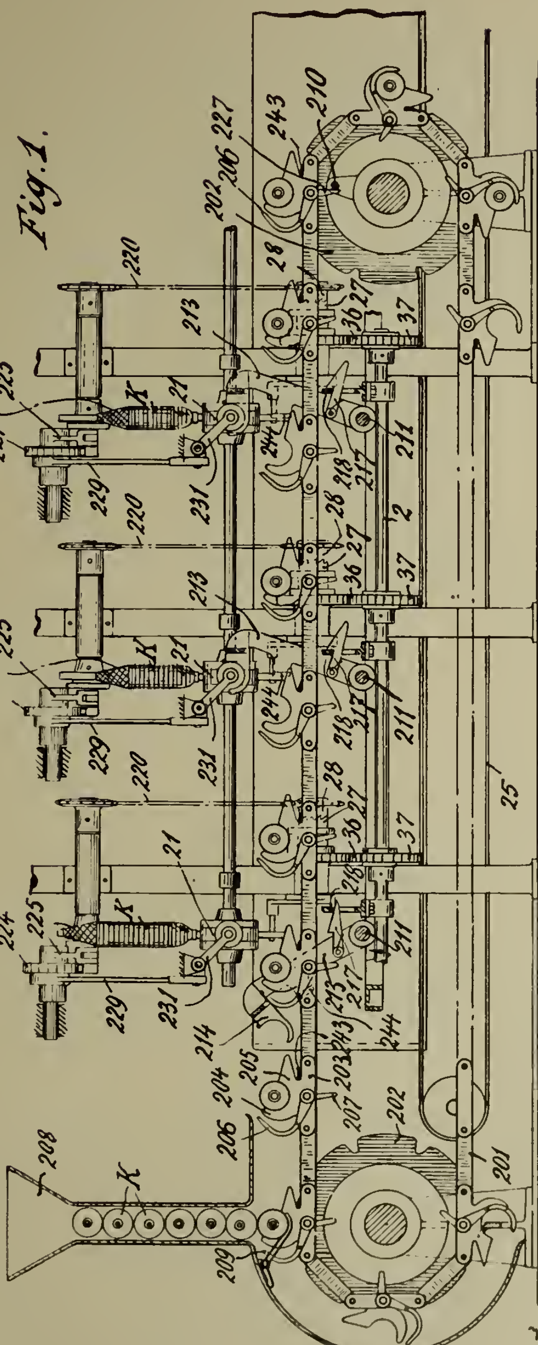

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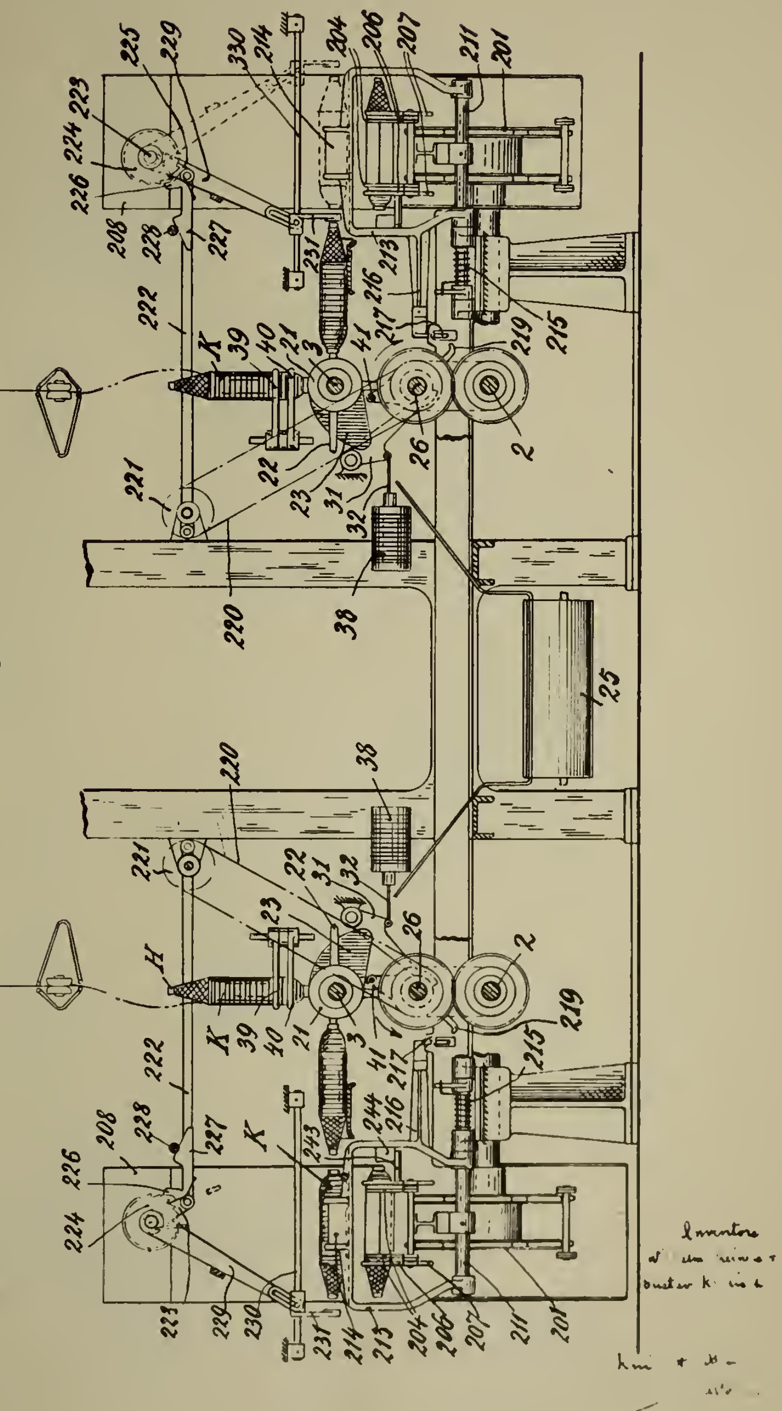
Fig. 2.



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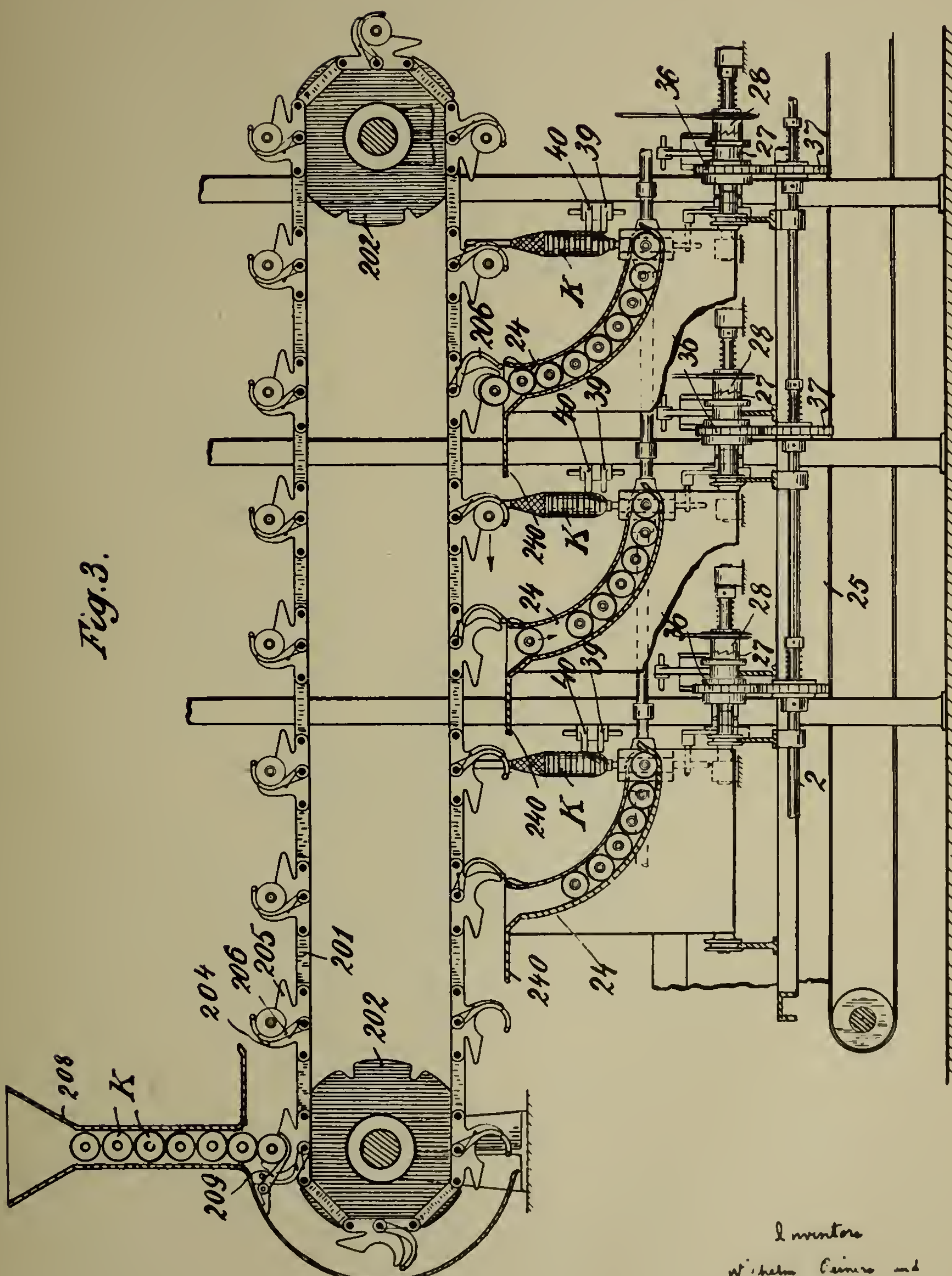

Fig. 3.

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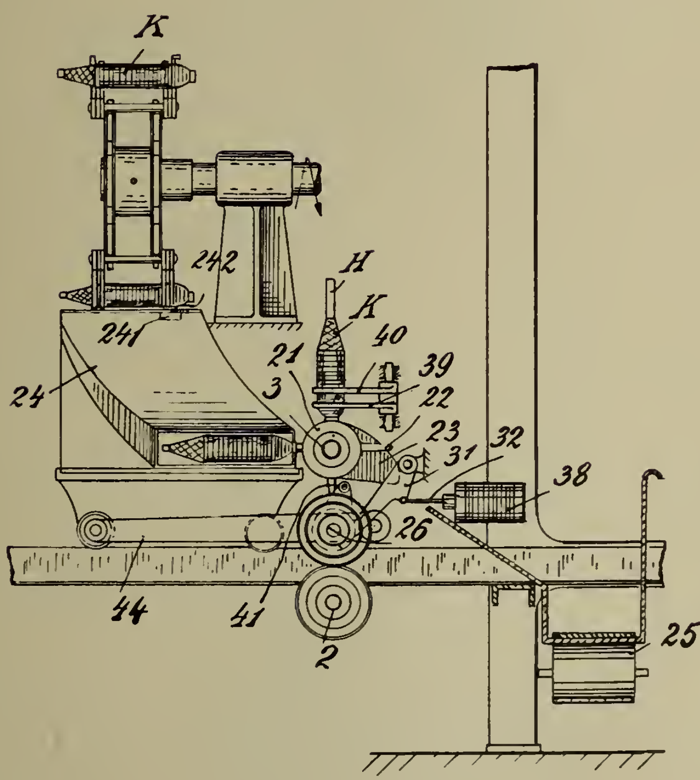
Fig. 4.



Inventors

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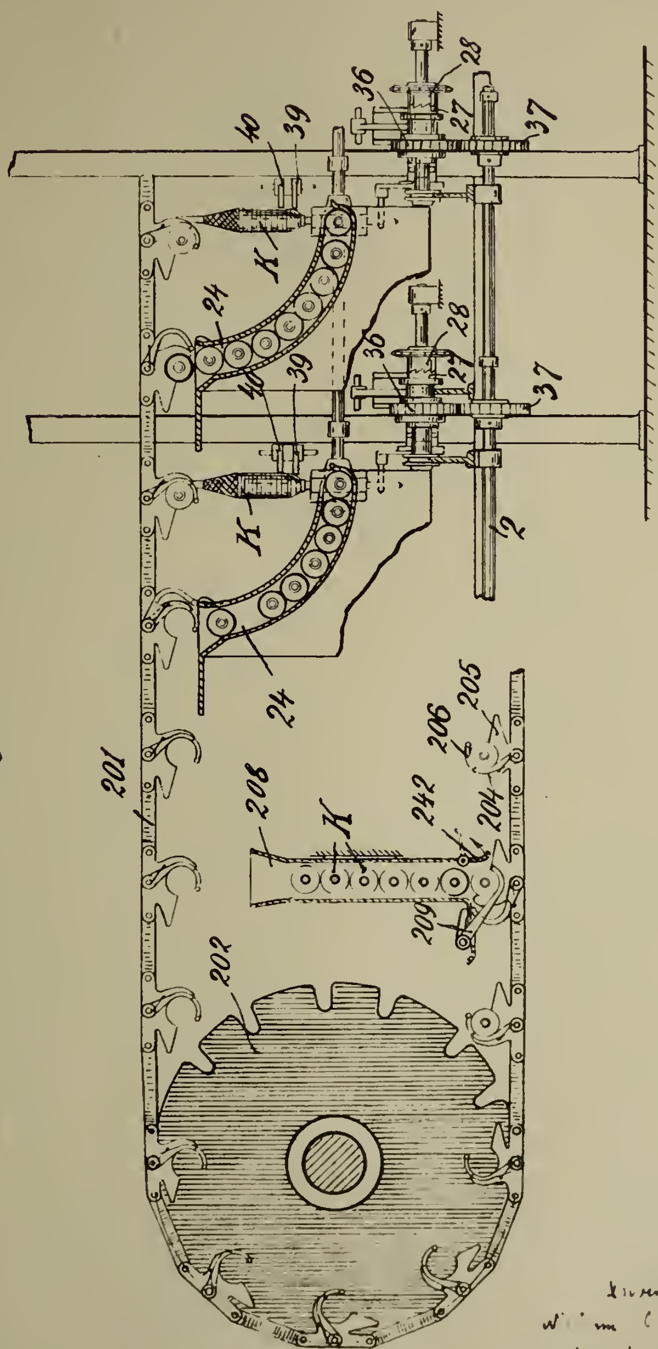
Fig. 5.



Published June 1, 1943

Serial No. 382,100

ALIEN PROPERTY CUSTODIAN

AGGLOMERATED BODIES OF CARBONACEOUS MATERIAL AND PROCESSES FOR MAKING THE SAME

Georges Passclecq, Paris, and Alexis Séménoff, Villers St.-Paul, France; vested in the Alien Property Custodian

No Drawing. Application filed March 6, 1941

Tars, pitches, bitumen, asphaltum or similar products are generally used as binding agents for the manufacture of agglomerated bodies of carbonaceous material. These substances have to be used in important quantities—up to 25 or 35% in case of wood charcoal—in order that the agglomerated bodies obtained will have a sufficient mechanical resistance when handled industrially; these binding agents, beside their use in high proportions have the disadvantage to destroy the porous structure of the carbonaceous material, especially in the case of charcoal, and give rise, during the combustion, to the distillation of very inconvenient tarry products, as it is well known, in almost all applications.

To avoid these disadvantages, it has already been proposed to agglomerate charcoal powder by means of solutions of molasses, dextrin, starch, lignosulphonates, sugar etc, but the agglomerated bodies thus obtained have the disadvantage to be of a weak density, even if an important proportion of the binding agent solution is used; besides, in that last case, a prolonged drying is necessary on account of the great quantity of water to be evaporated; finally, the evaporation of the water gives rise to the formation of pores which conduce themselves to decrease the density of the agglomerated body.

It has also been proposed to treat wood charcoal powder with water or aqueous solutions, by adding for instance wetting products; to mould the mass obtained, as much as possible without pressure, and to dry the products thus formed. But the low mechanical resistance of such agglomerated bodies does not permit to transport them in bulk and makes their use little advantageous.

At the knowledge of the Inventors, none of the above mentioned processes have ever been used commercially.

Now, we have found according to the present invention, that it was possible to obtain agglomerated bodies of carbonaceous material having a considerable commercial value by moulding under pressure a mixture of powders of carbonaceous material, of water, of a cold-binding agent, of a hot-binding agent and of a wetting and dispersing agent, preferably non-foaming or little foaming.

By "powders of carbonaceous material", it has to be understood pulverulent material containing a very important proportion of carbon, such as powder of charcoal, powder of coke, of coal or of vegetable matters, of powder of gas coke or metallurgical coke, or any other powders of similar matters, i. e., fine powders of anthracite or close burning coal, and pulverulent graphite having a lamellar structure or not. Generally very fine carbonaceous powders will be used, although it is likewise possible to use mixtures of powders of various thicknesses, especially mixtures of comparatively coarse powders and fine powders with, eventually powders of a medium thickness.

By "cold-binding agent", it has to be understood a product which is capable, when in aqueous solution or emulsion, to stick together, at low temperature, the particles of carbonaceous material. Will answer to such conditions, for instance: the dextrin, the glues, the gums, the casein or the natural or synthetic resins.

By "hot-binding agent", it should be understood a product capable of being converted into caramel or coke at a high temperature and which is therefore apt to unite together the particles of carbonaceous material by means of a kind of coke net work; products answering to these conditions are i. e., the monoses, the polyoses, the sugars, the molasses, the raw products, soluble or not in water, coming from the hydrolysis of the wood.

By ""Wetting and dispersing agent, preferably nonfoaming or little foaming", it has to be understood a product which facilitates the mutual dispersion of the solid material and of the water, but preferably giving not rise to the formation of inconvenient foam; such products are i. e., the products of condensation and sulphonation of aromatic hydrocarbons and of their derivatives with the aldehydes, the alkoyl and aralkoyl-naphtalene sulphonates, the residual lies of sulphite cellulose, the sulphonated derivatives of the fatty bodies, the esters of fatty acids, the products of the sulphonation of the residues of the distillation of the benzaldehyde, the products soluble in water resulting from the action of the ethylene oxide on bodies insoluble in water and containing a reactive hydrogen, as well as substances of a vegetable origin having wetting and dispersing properties, such as the licorice, the products of hydrolysis of albuminoids, the lies resulting from the treatment of ligneous substances by sulphites or bisulphites, and even, should the case happen, of the substances of vegetable origin having, in addition to dispersing properties, an appreciable foaming power, i. e. the saponin.

By "lies resulting from the treatment of ligneous substances by sulphites or bisulphites", it has to be understood that this expression covers, in a general way, all products or residues of the various fabrications of cellulose under the condition

that they contain lignosulphonic acids and that they have a pH above 6.8 (or brought to this value) in order to avoid a rapid deterioration of the machines and tools used during the various phases of the agglomeration.

Non-foaming dispersing agents are preferably used, according to the present invention, in order to avoid the necessity of taking particular measures, at the moment of the agglomeration, for expelling out of the agglomerated body, the air bubbles formed by the foam.

To form agglomerated bodies, according to the invention, the powder of carbonaceous material and an aqueous solution of the cold-binding agent, of the hot-binding agent and of the wetting and dispersing agent are mixed together. It is advantageous to determine the proportion of solution in the mixture, with respect to the quantity of carbonaceous material powder, so that the mixture initially offers the consistance of a moist mass, or even of a comparatively dry paste. The proportions of aqueous solutions, or especially of water, with respect to the other constituting substances of the mixture, are to be determined in each case by prealable experiments, with, as object, to obtain the desired density for the agglomerated body with an as low as possible pressure, and to reduce at a minimum the quantity of water which is to be evaporated. Good results and even very good results are generally obtained with a proportion of 8% of water with respect to the total weight of the mixture.

Instead of carbonaceous powder of a single kind only, it is possible to introduce into the mixture, carbonaceous powders of various kinds, i. e. of coal, of vegetable wastes, of lignite, and it is also possible to introduce into the mixture a small proportion of preserving agent, in order to protect the organic material against putrefaction during the making, or metallic salts capable to act as catalysers, in view to satisfy to the different cases which can be encountered or to improve the properties of the finished agglomerated bodies. A particularly advantageous solution of the manufacture of agglomerated bodies of carbonaceous substances consists, according to the present invention, to agglomerate an intimate mixture of charcoal, i. e. in the proportion of one third (⅓) and close burning coal or anthracite in the proportion of two thirds (⅔). In such an agglomerated body the charcoal facilitates considerably the lighting and the combustion, and decreases the total percentage of ashes with respect to that given by the mineral coal itself.

The so obtained mass is moulded by compression in the hot or in the cold; the higher the density desired, the higher will also be the pressure put into working. The moulded products are then dried and eventually baked, in order to convert into caramel or coke the binding agent. By using a heated press, or, as in the case of the making of lignite briquettes, by effecting the compression with a displacement of the agglomerated body in the mould insuring a sufficient production of calories, it is possible to suppress the cold-binding agent, taking care that the temperature to which the agglomerated body is submitted during the compression should be high enough, i. e. from 400 to 450° C., to convert into caramel or coke the hot-binding agent, which permits, in this case, to partially and even totally suppress the cold-binding agent.

Another possibility, according to the invention, is to use a mixture of substances composing at the same time the cold-binding agent and the hot-binding agent, instead of two various substances composing one the cold-binding agent, the other the hot-binding agent; such is the case especially of the sugars as well as of the hydrolysed wood, the latter containing simultaneously dextrin and glucose.

The non-foaming dispersing agents do not require normally special precautions during the agglomeration and are consequently put into working in an easier, and in the whole, less expensive way. The foaming dispersing agents may necessitate on the contrary the use of a compression apparatus permitting the evacuation of the air out of the agglomerate during the moulding.

Whatever the manner used to make the agglomerated bodies, it is possible, if desired, to polish them or to coat them with a waterproofing layer by means of a varnish or of a paraffin solution. Besides, the polishing can also be the result of an action exerced during the compression on the outer surfaces of the agglomerated body. Such processes of polishing are well known as such; it is therefore unuseful to describe them more clearly.

The agglomerated bodies obtained according to the invention, have the following properties amongst others: a very high content of carbonaceous material, an excellent mechanical resistance, a high density, a very regular burning without disintegration and which subsists in the open air without flame or fumes if the compression is not particularly high and if a sufficient proportion of coal of an easy burning, i. e. powder of charcoal, is contained in the agglomerated body. These properties give a very special value to such agglomerated bodies for their use in metallurgy, in industrial or house heating apparatuses and in stable or mobile gas producers. Moreover, when they are prepared starting from charcoal, they can, on account of their important adsorption capacities, be used for all applications of active coal: bleacking, purification, cleansing, fixation of certain gases in a gas mixture.

The following are examples of a few concrete cases of the manufacture of agglomerated bodies according to the invention. The volume of the agglomerated bodies can be whatever and correspond for instance, to the pieces of natural, treated or artificial combustibles presently used for the various considered applications. In these examples the parts by volume are taken so that in the case of the water, one part by weight is equal to one part by volume.

Example 1

1000 parts by weight of coal powder passing through a sieve of 80 meshes, were introduced by kneading in 80 parts by volume of an aqueous solution containing 20 parts by weight of dextrin, 20 parts by weight of molasses, 4% of the sodium salt of a sulphonated condensation product of naphthaline with formol, for instance of Diastersol NDS.

The mixture was allowed to rest during a few hours, then it has been moulded in the cold, under a pressure of 100 to 250 Kgs per cm^2 and the agglomerated bodies thus obtained have been dried at 120° C.

Example 2

1000 parts by weight of charcoal powder passing through a sieve of 120 meshes, were mixed with 80 parts by volume of an aqueous solution

containing 10 parts by weight of molasses, 10 parts by weight of dextrin and 2% by weight of butylnaphthalene-sodium-sulphonate. The mixture was moulded in the cold under a pressure of 500 Kgs per cm^2 and the agglomerated bodies thus obtained were dried at 120° C.

Example 3

1000 parts by weight of charcoal powder passing through a sieve of 80 meshes were mixed intimately with 160 parts by volume of an aqueous solution containing 40 parts by weight of dextrin, 40 parts by weight of molasses, 8 parts by weight of isopropylnaphthalene-sodium-sulphonate. The mixture was moulded in the cold under a pressure of 100 Kgs per cm^2, the agglomerated bodies thus obtained were dried at 120° C and baked at a temperature of about 450° C.

Example 4

1000 parts by weight of metallurgical coke were crushed in pieces or dust and the powder obtained was mixed, as in above example 1, with 100 parts by volume of an aqueous solution containing 25 parts by weight of dextrin, 25 parts by weight of molasses, 5 parts by weight of the sodium salt of a sulphonated condensation product of naphthaline with formol, for instance of Diasterol NDS. The mixture thus obtained was introduced in a slubbing machine capable to compress at 100 Kgs per cm^2. Agglomerated bodies of a density of 1.5 keeping their shape and their hardness at high temperatures and capable to be used with advantage in metallurgy, were so obtained.

Example 5

500 parts by weight of gas coke on the one hand and 500 parts by weight of charcoal on the other hand were crushed; the two powders obtained were mixed with 150 parts in volume of an aqueous solution containing 35 parts by weight of dextrin, 35 parts by weight of molasses, 7 parts by weight of the sodium salt of a sulphonated concentration product of naphthaline with formol, for instance of Diastersol NDS. The mixture was moulded in the cold under a pressure of 100 Kgs per cm^2; the agglomerated bodies thus obtained were dried at 120° C. and baked at 450° C. Agglomerated bodies of a density of 1.20 burning completely in the open air were obtained.

Example 6

1000 parts by weight of charcoal powder were crushed, and the powder obtained was mixed, as in example 1, with 150 parts by volume of an aqueous solution containing 35 parts by weight of dextrin, 35 parts by weight of molasses, 7 parts by weight of a condensation product of cetyl alcohol with 18 molecules of ethylene oxide. After the mixture had been intimately mixed it has been moulded in the cold under a pressure of 100 Kgs per cm^2, and the agglomerated bodies obtained were dried at 120° C.

Example 7

1000 parts by weight of charcoal powder passing through a sieve of 80 meshes were gradually introduced, by kneading, in 150 parts by volume of an aqueous solution in the following manner: by one of the well known processes, natural graphite was transformed in graphite acid which was washed, dried and heated in a closed vessel at a temperature of about 800 to 1000° C. The graphite swelled and occupied a volume which was about twenty six times larger than before heating. Once the swelling terminated, the graphite was compressed into lozenges under a pressure of 50 to 1000 Kgs per cm^2 and these lozenges were heated at a temperature of about 500° C which caused a new swelling of much less intensity. The volume of the lozenges increased from one to three time its initial value while the lozenges were disintegrated in a certain measure but remained agglomerated with a tendency to again take their former foliated structure. The so treated lozenges were finally crushed again, by means of an easy crushing operation.

100 parts by weight of the graphite obtained as said above were mixed with 5 parts by volume of an aqueous solution containing, per litre:

	Grams
Dextrin	150
Molasses	400
The sodium salt of a sulphonated condensation product of naphthalene with formol	50

The mixture was mouded under pressures varying between 25 and 1000 Kgs per cm^2, according to the wanted hardness, and the agglomerated bodies were heated to a temperature between 400 and 600° C. in a time of about 20 minutes. The so obtained agglomerated bodies were submitted to a second baking, in a bath of boiling pitch at 400–500° C.

Graphite agglomerated bodies appeared as being containing by weight, 40 parts of dextrin, 40 parts of molasses and 8 parts of sodium lignosulphonate. The mixture obtained was moulded in the cold under a pressure of 100 Kgs per cm^2 and the agglomerated bodies obtained were dried at 120° C.

Example 8

In the process described in Example 6, the 7 parts by weight of the condensation product of cetyl alcohol with 18 molecules of ethylene oxide were replaced by 7 parts by weight of butylnaphthalene-sodium-sulphonate, or by 7 parts by weight, of sulphonated lauric alcohol, or by 7 parts by weight, of sulphonated ricinate of butyl; or by 7 parts, by weight, of the sulphonation product of the residue of the distillation of benzaldehyde; or by 7 parts, by weight, of the product as in Example 1.

Example 9

1000 parts by weight of Tonkin anthracite were crushed and mixed progressively, by kneading, with 80 parts in volume of an aqueous solution containing, per litre:

	Grams
Dextrain	250
Molasses	250
A condensation product of cetylic alcohol with 18 molecules of ethylene oxide	70

After intimate mixing, the substance was moulded in the cold under a pressure of 300 Kgs per cm^2. The agglomerated bodies were dried at 120° C. Their density approached 1.4.

Example 10

Graphite in a divided state was first prepared fit for the production of electrodes, retorts, muffles, crucibles, and other manufactured articles of which graphite forms a part.

GEORGES PASSELECQ.
ALEXIS SÉMÉNOFF.

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ALIEN PROPERTY CUSTODIAN

BREECH DEVICE FOR FIREARMS

Josef Koucký, Prag-XIX, Bohemia; vested in the Alien Property Custodian

Application filed March 8, 1941

The present invention relates to a breech device for firearms especially for those of smaller caliber, quite indifferently whether it be a repeater, an automatic or semi-automatic firearm. The present invention relates to a breech device for such firearms in which projectiles of a greater force of percussion it means, cartridges developing a greater initial pressure and having a higher speed of firing are used.

This object is attained according to the present invention by this that there is arranged in the firearm a breech device characterised by a breech block forming a flat prismatic body, tiltable around the longitudinal axis of the firearm and provided with locking pegs which, in tilting the breech block are co-operating with the cuttings formed in the casing of the firearm respectively in the casing of the breech device. The breech block forms an appropriate quadri-lateral prism the basis of which having a manifold greater length than hight and which is chamfered along a shorter length than the length of the body on the opposite parallel side-walls by parallel planes. Without counting that the arrangement according to the present invention considerably diminishes the hight of the casing and thus also the weight of the firearm, a more advantageous formation of the breech block with regard to a more favourable straining by the pressure of the gases produced in firing the cartridges, is obtained. Thus it is also possible to use cartridges with a greater powder charge and therefore also a more violent force of percussion.

The accompanying drawing shows the arrangement of the device according to the present invention in two modifications. In Figs. 1 to 4 is shown the arrangement in the case of a repeater, which in Fig. 1 shows the longitudinal section of the breech block closed. Fig. 2 is a perspective view of the breech casing with the breech block open. Figs. 3 and 4 are transverse sections of the firearm following the lines III—III and IV—IV of Fig. 1.

Another example of the arrangement of the breech device in an automatic gas operated firearm is perspectively shown in Fig. 5.

The firearm shown in Figs. 1 to 4 consists essentially of the barrel 1, which is fixed to the casing 2 of the breech by means of a screw thread; 3 is the front part of the stock, 4 is the upper part of the stock. In the under side of the casing 2 is arranged in a known manner the cartridge chamber 5 with the follower 6 charged with the spring 7. The trigger mechanism 8 is of a known construction and sets the hammer 9 in action. On the rear part of the casing 2 is fixed the butt 10. In the casing 2 of the breech moves the breech block 11 with the striker 11 charged with a spring 12′ and the ejector 13.

The breech block 11 is a prismatic body having the shape of a flat slab the two diagonally opposite edges of which are chamfered along the part l of their total length (Fig. 2) at the angle α. The length of the base-line of the prism is a multiple of its hight. The chamfering is made in such a manner that the opposite parallel side walls of the prismatic body are cut by parallel planes where the chamfering begins half-length of the base-line of the body. The remaining uncut part of the parallel side-walls of the jacket which belong to the longer side of the basis, form planes for guiding the breech block in executing the movement by which the breech block passes into the closed or open position. The chamfering of the opposite side-walls of the envelope is made by planes which deviate from the uncut part of the side walls by 15° to 30°. By the partial chamfering 14, 14′ of both edges respectively by cutting off the opposite sidewalls of the jacket of the body to the length l are formed the locking lugs 15, 15′ which are on that side which faces the cartridge chamber and show triangular interlocking surfaces 16, 16′. In tilting the breech block the lugs 15, 15′ fall transversely at the locking angle α, given by the chamfering angle, into the parts 17, 17′ cut out in the lower and upper interior wall of the casing 2. The lug 16 bears the bolt lever 18, which passes through a longitudinal cutting out in the casing 2 of the breech device. which ends in the locked position in a transverse slot 20, enabling the transverse motion of the bolt lever when locking the breech block.

When firing the breech block is located in the position shown in Fig. 4, when the lugs 15, 15′ engage in the cut out parts 17, 17′ and the breech block rests on both walls 14, 14′ on the upper and under guiding walls inside the casing. The back pressure of the propellant gases that acts at the moment of firing on the breech block is taken up by the planes 16, 16′, supposing that both reactions are acting in the centres of gravity of both planes, which centres of gravity are at the distance x from one another. As the breech block may be considered as a bearer supported in the graviating points of the locking planes being charged by a force acting about in the middle, is the strain according to the present invention much more favourable than in the known breech blocks, as the cylinder breech blocks with locking lugs projecting above the surface of the cylinder.

The strain is much more favourable because the bearing length is shorter and therefore under the same conditions the breech block may be more charged respectively stronger and more explosive charges may be used.

After firing the rifleman swings round the bolt lever together with the breech block from the position shown in Fig. 4 into the position shown in Fig. 3 at the angle α disengaging the teeth **15**, **15'** and the cut out parts **17**, **17'** and the full profile of the prismatic body of the breech block is placed against the transverse section of the bore of the hollow, so that by pulling back the bolt lever the breech block can be brought to the open position. During this movement the empty cartridge case is pulled out in a known manner and at the end of the movement ejected from the casing **2** and at the same time the firing mechanism is tensioned. By the forward movement of the breech block a new cartridge **21** is brought into the cartridge chamber and after having accomplished the locking movement the breech block is swung round at the locking angle α. As it is quite sufficient if the locking angle is about 15 to 30°, the movement of locking and unlocking requires much less time than in the devices up to now in which it has been generally necessary to swing round the breech block by 90°. This fact increases the speed of firing which in modern firearms is one of the most important requirements.

According to the invention the breech block may also be used in automatic firearms as may be seen in Fig. 5 in which is shown a perspective view and a fragmentary section of a gas operated firearm.

The firearm shown in the drawing consists of the barrel **1**, the casing **2** for the breech, in which the breech block **11**, which is constructed in quite the same manner as that in the preceding case, is movably located. The breech block is again chamfered at the two opposite edges where the chamferings **14**, **14'** begin also about the middle of the base-length of the prismatic body of the breech block. For actioning and governing there is a nut **22** fixed on the locking lug **15** which engages into the groove **23** at the end of the piston rod **24**, whilst the piston **25** of the piston rod reaches into the gas cylinder **26** and is guided in a known manner in the casing **2** of the breech device. The gas cylinder is tightly fixed to the barrel by means of a sleeve **27**. The forward movement of the breech device is assured by the buffer spring **28**. The governing groove is chosen so that at the first shock of the gases on the piston the breech block remains still closed during a certain time and only when the piston **25** after having travelled through a certain distance leaves the gas chamber, it is when the projectile has left the barrel, through the effect of the curved part of the groove **23** a swinging of the breech block **11** around the locking angle α takes place. After the unlocking has taken place, the piston rod **24** brings the breech block **11** into the rear end position. At the forward movement the pin **22** is at the upper front end of the groove **23**. As the lugs are completely in touch with the hollow of the breech block, the cartridge chamber cannot be coiled. For operating the breech by hand a tension cam **29** is adjusted on the piston rod.

The executions described are given only by way of example and may be varied in details without departing from the scope of the invention especially as far as the governing of the breech block and the like are concerned.

JOSEF KOUCKÝ.

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JUNE 1, 1943.

BY A. P. C.

J. KOUCKÝ

BREECH DEVICE FOR FIREARMS

Filed March 8, 1941

Serial No. 382,429

2 Sheets-Sheet 1

Fig. 1

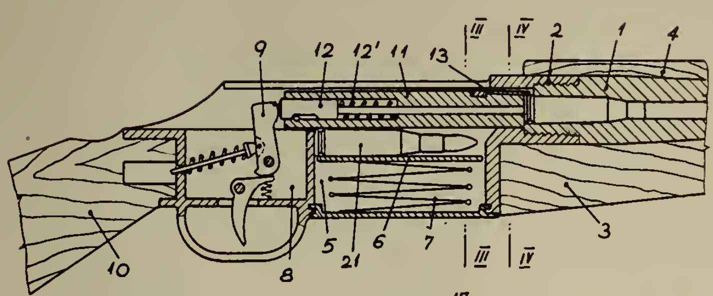


Fig. 2

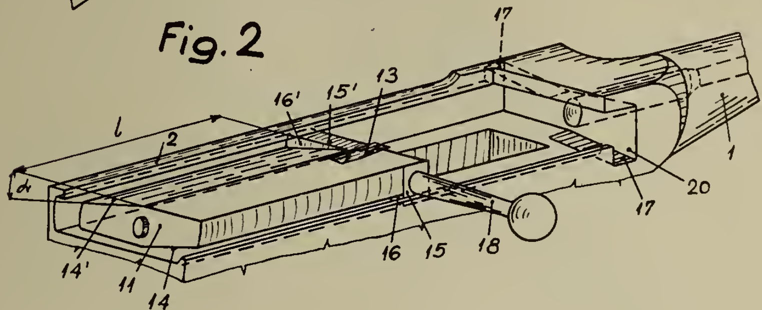


Fig. 3

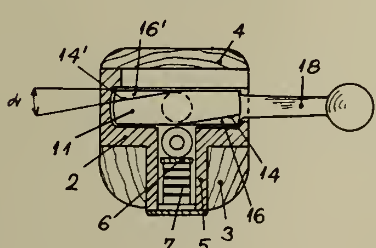
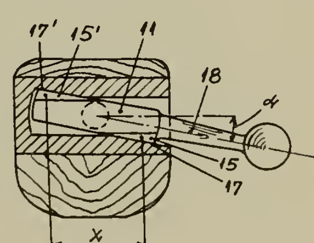


Fig. 4



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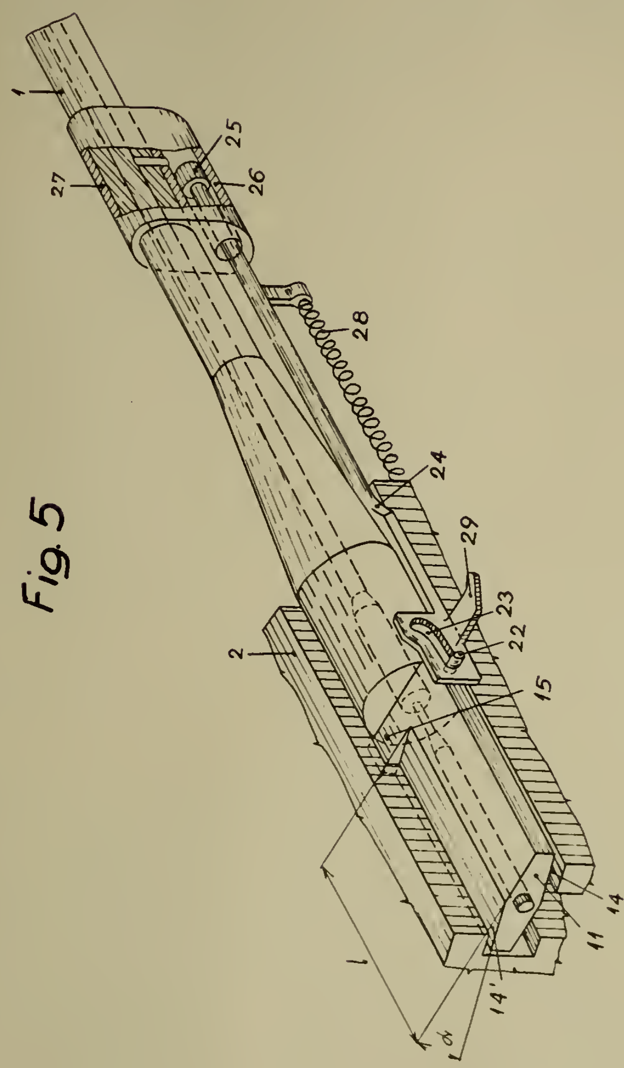
2 Sheets-Sheet 2

Fig. 5



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By

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ALIEN PROPERTY CUSTODIAN

STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES

Albert Callsen, Stuttgart, Germany; vested in the Alien Property Custodian

Application filed March 12, 1941

The invention relates to a starting device for internal combustion engines, in which the clutch element engaging on the internal combustion engine is engaged by a shifting arrangement as disclosed in my former patent application. In the device according to my former patent application the clutch element is shifted forward immediately at the beginning of the turning of the starting device. This form of construction is therefore not suited for starting devices, in which the energy required for the starting is first accumulated in a centrifugal mass or in a similar power accumulator. In order to make the shifting arrangement suitable for such starting devices one of the two elements to be mutually turned for effecting the forward shifting is, according to the invention, arbitrarily retarded or held.

Two embodiments of the invention are illustrated in section by way of example in the accompanying drawing, in which

Fig. 1 shows the first embodiment of the invention, and

Fig. 2 a modification of Fig. 1.

As shown in Fig. 1 an electromotor 10 is provided as driving engine for the starting device, a flywheel being keyed on the hollow armature shaft 11 of this electromotor. The flywheel is connected by a planet gear 12 with a friction disc clutch 13, which transmits the turning force of the centrifugal mass upon a sleeve 14. This sleeve 14 has on its inner side ledges 15 between which ledges 16 of a clutch element 17 engage which is shiftable in longitudinal direction in the sleeve. The inner distance between the ledges 15 of the sleeve, on the one hand, is so great and the width of the ledges 16, on the other hand, is so small that the clutch element 17 can rotate by a predetermined amount relative to the sleeve. A torsion spring 18 is inserted between the sleeve and the clutch element and destined to turn forward the clutch element relative to the sleeve in the direction of rotation of the starting device.

A shifting arrangement with a cam drive serves for engaging the clutch element. On a rod 19 located in the hollow armature shaft a cam disc 20 is fixed on that end of the rod which projects into the sleeve 14. On said cam disc 20 slides a tooth 21 of a disc 22 which is mounted so that it can rotate relative to the sleeve between a collar 23 of the sleeve and a friction disc 25 submitted to the pressure of a weak spring 24. A head 26 having grooves 27 is mounted on the other end of the rod. A pin 28 mounted on the circumference of the head is adapted to be brought into engagement with the grooves of head 26 by means of an electromagnet 29, so that in this position this pin prevents the rod from rotating.

For feeding the electromotor and the electromagnet a battery 30 is provided and connected with the electromotor by an electro-magnetically actuated switch 31, the exciter coil 32 of this switch being adapted to be switched in and cut out by means of a change-over switch 33, by which also the electromagnet 29 is controlled. The switch is constructed so that it actuates alternately in the one position the switch of the electromotor and in the other position the electromagnet.

The starting device operates as follows:

For starting the internal combustion engine the electromagnet 10 is first switched in and brings the flywheel to a high number of revolutions. The clutch 13, the sleeve 14 with the clutch element 17 and the cam disc 20 with rod 19 revolve at first idly with the flywheel. When the flywheel has attained the required number of revolutions, the switch 33 is laid over and the coil 29 switched in. The pin 28 engages in the grooves 27 of head 26 and thus secures the rod 19 against further rotation. The result hereof is, that the tooth 21 slides on the cam disc 20 and shifts the rod 19 towards the clutch element and engages this clutch element. When the front ends of the claws of the clutch elements encounter the one the other, the shifting forward of rod 19 is prematurely stopped. The shifting force exerted in axial direction by the rod 19 remains, however, low for the reason that disc 22 can slide between stop 23 and disc 25. The clutch element 17 can therefore easily be turned by the sleeve 14 moving behind the same, in order that this clutch element can engage into the next following gap.

The embodiment shown in Fig. 2 differs from the first embodiment only as regards the shifting arrangement for the claw, the other elements, as far as they are shown, are therefore designated by the same reference numerals as in Fig. 1. The clutch claw 40 is pushed forward by a nut 41 which is arranged in sleeve 14 so that it can shift in the longitudinal direction and can be drawn along by the ledges 15 of the sleeve. The nut can screw on a screw-threaded piece 42 of a rod 43 provided in the starting device. The rod projects, on one side of the screw-threaded piece, into the clutch claw and carries on its end a ring 44 fixed on it by pins. In this ring 44

one end of a helical spring 45 is fixed, the other end of said spring being fixed in the clutch claw. This spring corresponds to the torsion spring 18 of Fig. 1. On the other side of the screw-threaded piece a rod 43 extends beyond the electromotor and carries a grooved head 46 which bears against the bearing shield 47 of the electromotor and prevents the rod from shifting relative to the claw. A friction disc clutch 48 is mounted on the grooved head. Some of the friction discs are connected with the grooved head and the other friction discs with a sleeve 49. The friction discs are under the pressure of a spring 50 which presses the discs against a supporting plate 51. The sleeve 49 has grooves 52 in its outer side into which grooves a pin 53 can engage which is moved by an electromagnet 54. The switching of the electromagnet is similar as in the first embodiment of the invention.

During the upward turning of the centrifugal mass the pin 53 is not in engagement with sleeve 49. The rod 43 can therefore turn with the nut 41 or with the sleeve. When the upward turning is terminated and the driver switches in the electromagnet 54, the pin 53 comes into engagement with the grooves of sleeve 59 and stops the rod 43 by means of the friction clutch 48. Consequently the nut 41 screws forward on the screw-threaded piece 42 and pushes the claw in front of it. When the forward shifting is terminated the weak friction clutch 48 slides through.

ALBERT CALLSEN.

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Fig. 1

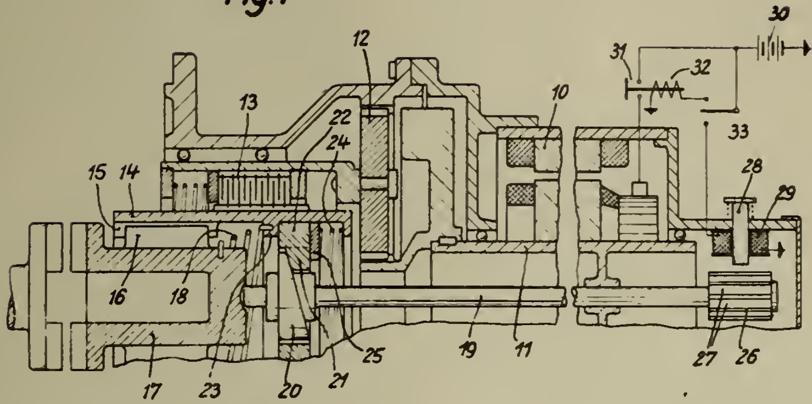
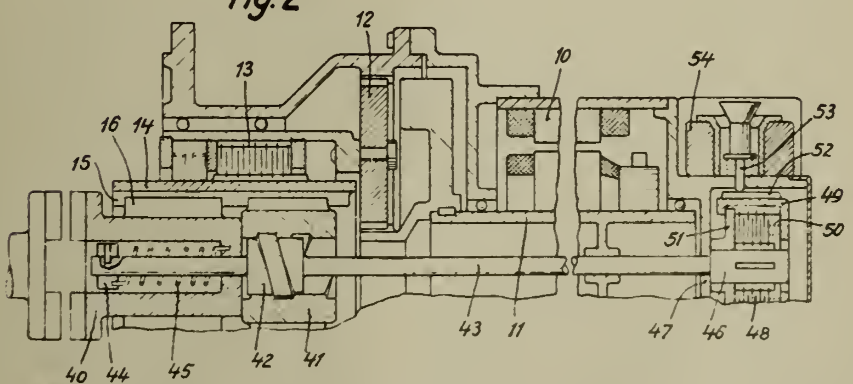


Fig. 2



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ALIEN PROPERTY CUSTODIAN

COPYING SOUND EVENTS TAKEN IN AMPLITUDE RECORDS

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Application filed March 12, 1941

The present invention relates to a method of copying sound records taken in amplitude records. More particularly the invention relates to a method of copying very long coherent sound records which with the aid of a needle or a luminous sound have been recorded upon a sound carrier as transverse vibrations, i. e. in amplitude or indented records. As a rule, a film strip is used as sound carrier.

It is well known to engrave on a strip-like sound carrier acoustic events in the form of grooves by means of a cutting needle and to tightly fill the sound carriers (sound strips) with such grooves. By means of such sound strips acoustic events of nearly any desired duration may be recorded and reproduced. With a length of strip of for instance 100 m. and 100 grooves upon each side, the duration of play is about 12 hours, provided the cutting or scanning speed amounts to 45.6 cm. in the second. The nature of the strip as well as the density and the arrangement of the grooves at both sides render copying of the strip rather difficult. Some copying methods cannot be used at all particularly the very advantageous optical methods. These and other reasons may have been the cause that it has not yet become known to copy such strips, particularly strips in this length, as often as desired.

Moreover, it is also well known to produce by means of luminous signals upon one side of a strip-like sound carrier several sound traces side by side in transverse signals. Such sound traces, recorded with luminous sound, have already been treated in a manner similar to that of a light copying method by changing these traces into a gelatin swelling relief, producing therefrom intermediate galvanos and then using these for copying the original sound carrier. In another connection finally it is known to change by means of etching a luminous sound record into a needle sound record by recording the luminous sound in transverse signals in a trace the brightness of which changed from the middle line to the margins so that on etching of the trace recorded with luminous sound an elevated or deepened reproduction of the differently lighted portion was obtained which either directly resulted in a needle sound trace or during copying could be changed into such a sound trace.

The present invention, however, solves with the use of simple means the problem to directly produce from an original record a matrix without the original, for the purpose of copying, being prepared mechanically, by electrolysis or in an other manner and particularly without subjecting the original sound strip to the action of a chemical bath. The use of this method results in a practically unlimited number of copies of sound strips of greatest exactness without any danger of wear. If desired, the new method may be carried out in semi or fully automatically working.

The new copying method starts from sound events recorded in transverse signals the width of the trace of which shows differences in brightness. These differences of brightness may be due to a differently strong exposure of the width of the trace (luminous sound trace) or to a different thickness of the strip over the width of the trace (needle sound). The new copying method consists in producing from the record, for instance, photochemically a print form, or an intaglio form, refraining from effecting prints from these forms but preparing by impressing a copy or a plurality of copies capable of being scanned by a needle. For the purpose of the invention the knowledge is of importance that in all printing methods, operating without a screen, differences in brightness must be changed to differences in the height of the print form and therefore the method and the means for carrying out the method must be developed as delicate as possible. For the purpose of the invention these differences in height are satisfactory and impressions are made with the aid of same.

The invention shall now be described by means of a luminous sound record as example. First of all the original record is made which may be obtained by a light beam falling in point—or gap—form upon a light sensitive film strip and being controlled by the sound frequency in such a manner that a wave-line in the manner of the Berliner record (amplitude or transverse record) is produced as in connection with a disc record, however, with different brightness in the width of the trace. After an ordinary development, the record appears as a wave-line the width of which is differently dark, whereas the points of the film strip not subjected to the light remain transparent. To obtain a definite profile of the material between adjacent grooves upon the matrix it is of particular importance that for instance the light gap changes from the middle towards both sides in the manner of a gray wedge.

This gray wedge-like change of brightness may be decreasing or increasing from the middle of the strip outwards. The middle of the strip, therefore may be the darkest or the brightest

portion. The latter particularly simple case is shown in Fig. 1.

The invention, moreover, consists in the knowledge that it is of no importance for the transfer of the intaglio method known in the printing art upon the copy of sound films whether the original record had been made with the aid of luminous signals or by means of a needle sound. The transverse luminous record and the needle record are equivalent for the new method and, therefore, may be replaced one for the other whenever desired. The examination of a needle sound record by means of light rays also results in a record strip the brightness of which changes from the middle line towards the margins. In the sense of the invention both kinds of record, therefore, photochemically allow the production of a metallic printing form having sound records in relief, i. e. the production of metallic forms which may be used for the direct production of a large number of very exactly impressed copies.

After these explanations, a short hint only is required for the average expert, that, of course, the reproduced needle sound copies may be changed to a strip-like transverse record extending upon the surface of the carrier and capable of being scanned by luminous sound by means of a simple further step in the method, i. e. by means of a light copying process. Finally it is clearly to be seen that in copying in accordance with the new method, the original sound strip is subjected to light rays only and is in no manner chemically or otherwise changed.

In the drawings the means for carrying out two of the various possible methods are shown according to which the originally produced film may be recorded as a light strip the width of which is of different brightness.

Fig. 1 diagrammatically shows the production of a matrix. II is the negative of I. By means of this negative the pigment paper III is exposed. The light rays, indicated by arrows, enter the uncovered portions of the negative, more or less penetrate the chromium gelatin layer in dependence on the blackening of the negative and effect a reduction of the water solubility of said layer. The exposed pigment paper band III is transferred to the copper strip V and then rinsed with water. The portion of the gelatin layer which remains soluble is washed away, whereas the exposed portion is remained as groove relief, because it is hardened by the exposure. The then following etching of the copper strip with a solution of iron chloride solves the copper first at such points at which the copper strip is most weakly covered by the gelatin relief, whereas the etching solution slowly penetrates the swelling gelatin and the etching occurs later on. In this manner the groove relief with all its finenesses is transferred upon the copper strip. After etching, rinsing of the copper strip is effected and the copper strip matrix is finished.

As may be seen from Fig. 1 the method beginning with taking the record and ending with the finished matrix consists of five operations. One of these operations may be omitted, if the original exposure I is made upon a photographic reversal film, because then the production of the negative II is rendered superfluous.

The exposure may also be effected without the use of a gray wedge. In this case the etching would be effected in accordance with the line etching method by which the material between the grooves is profiled by means of repeated colorings and etchings with differently strong etching solutions.

For the manufacture of sound films on a factory scale a particular advantage of this step of the method according to the invention consists in this that in spite of the fact, that the copy is to be scanned by a needle guided in the sound groove, the needle is dispensed with on taking the record which needle is rendered blunt by taking records extending over several hours, and that, moreover, due to the needle being dispensed with no chippings are produced. Consequently also the unavoidable inexactnesses and uncleannesses are dispensed with which accompany any finishing based upon removal of chipping in contradistinction to deforming operations.

Should it be desired for special purposes to listen to a record at once, this may be effected by means of a cutting needle. Hereby one side of the sound carrier which also may be a disc record is provided with a thin black layer (shown in Fig. 2 at I). Or for reproducing purposes the record is copied upon a photographic film so that for the exposure of the matrix the sound groove is bright. To effect the exposure the record I is brought upon the copper strip III provided with the copying layer II. After the exposure the development, rinsing and etching is effected. Hereby it is to be considered a favorable circumstance that by the profile of the cut groove the light permeability of the sound carrier, now transparent at this point, is as good as if the gray wedge increasing in darkness from the middle towards both sides would have acted in the same manner as during taking the record with light gap.

If the record in form of grooves has been made upon a strip which has no black covering or coating the latter may be applied after taking the record, as the color, for instance by rolling, covers the surface of the strip only, whereas the grooves, due to their depth, being left free.

In each case an intermediate negative of the record is used as copy which negative has been produced as printing form for instance photochemically by means known in the printing art. Each method may be used which results in printing forms in relief which are practically free of screens and mechanically of sufficient [illegible]th and the margins of which are part[illegible] exact.

Figs. 3–7 show by way of example a construction adapted for carrying out, with photochemical means, the entire novel copying method. As the number of copies is very large there may also be the question of a reproduction method. The entire device is represented in subdivided portions in Figs. 3, 4, 5 and 6. This device in a coherent operation allows the production of copies of sound records upon film strips which are scanned from the copy by means of a needle.

In the accompanying drawings:

Figs. 1 and 2 diagrammatically show fundamental details,

Fig. 3 diagrammatically shows a portion of the device within which the copper strip serving as matrix is cleaned,

Fig. 4 diagrammatically shows the device for drying the strip and applying the copying layer, and, moreover, illustrates the copying and developing of the copying layer,

Fig. 5 diagrammatically shows the means for effecting etching and rinsing of the copper strip,

Fig. 6 illustrates five sections through the strip indicating the individual phases of the production of the copper strip matrix,

Fig. 7 diagrammatically represents the impressing of the matrices into the film material,

Figs. 8 and 6 are two sections through the strips showing the operation before and after the impressing respectively,

Fig. 9 diagrammatically shows the arrangement for impressing both sides of a strip the two ends of which are later on stuck together to form an endless reel,

Fig. 10 diagrammatically shows the point of connection of the copper matrices shown in Fig. 9, and

Fig. 11 diagrammatically shows the register of the point of sticking together the ends of the strip.

In carrying out the method according to the invention the fact is utilized that for instance chromium gelatin has the property of losing depending on the magnitude of the entering amount of light more or less its solubility in water under the action of this light. Chromium gelatin, therefore, is suitable as carrier for the sound copy of a sound recorded upon a film by means of light.

A mixture of fish-glue, distilled water, ammonium bichromate and ammonia for instance is suitable as copying layer.

The action is such that light rays falling into the layer more or less actively act upon the copying layer in accordance with the density of the film to be copied and in this manner effect a change of the water solubility of the layer. The change of the water solubility is the stronger, the deeper the light penetrates. At the most transparent points of the film to be copied, therefore, the change of the water solubility is largest and at the most covered points it is most weakened.

Wound upon the drum **1** is the metal strip, for instance a copper strip, serving as matrix which, as shown in Fig. 3, enters the tank **2** when unwound from said drum **1**. In this tank the copper strip is cleaned by means of a swabber and a pulp of prepared chalk and a caustic alkali solution. In the tank **3** rinsing with water is effected which is supplied by a pipe **4** and discharged by a pipe **5**. The tanks **6** and **7** also serve for cleaning purposes. The tank **6** preferably [illegible] with spirit and the tank **7** with a mixture of water and spirit. The drive for the feed of the copper strip **8** is effected by a motor **9** which also drives the swabber **10**. The rollers **11** and **12** effect drying of the strip.

The tank **13** contains the mass of the copying layer which, for instance, may be of the already mentioned composition and is applied at **14** upon the copper strip **8** in a thickness of about 0,2 mm. On the way to the copying lamp **16** the copying layer is dried and for this purpose a heating apparatus **15**, eventually together with a centrifugal blower, is provided.

If the strip **8** moves below the lamp **16**, the film **25** to be copied and unwound from the drum **23** and guided between endless strips **17** and **18** by the rollers **19**, **20**, **21** and **22** is applied to the strip **8** provided with the copying layer **26**. The transparent guide strip **18** hereby has the purpose of ensuring a good contact between the strip **25** provided in the example shown with four sound traces **34** and the strip **8**. After exposure by the lamp **16**, the strip **25** is wound upon the drum **24**, while the strip **8** carrying the copying layer **26** is developed in the tank **27** with water, supplied and discharged by pipes **28** and **29** respectively, by the fact that the portion of the copying layer **26** which remains water soluble due to the light rays not penetrating is rinsed away, whereas the water unsoluble portion remains as webs between the grooves. Before the strip enters the etching bath in the tank **31**, the lower side of same is covered at **32** with a fast drying acid proof layer of lacquer which prevents that the etching liquid attacks the lower side of the copper strip **8**.

The etching operation is such that the etching liquid, in the method described by way of example a solution of iron chloride, first attacks and solves the copper strip covered with the groove relief formed by the copying mass remaining after development, at such points at which previously the light has most strongly impinged, and that the chloride solves the copper the deeper, the longer it acts. Practically, therefore, the groove relief from the copying mass is transferred to the copper strip, as the chloride is prevented from attacking the copper strip by the groove relief acting as protective layer.

In the tank **33** a last rinsing of the strip **8** with water is effected and then the copper strip matrix is finished. The sound grooves now remain upon the copper strip **8** as webs **34** in relief. On further movement of the finished matrix **8** the latter reaches the device shown in Fig. 7.

Here the film strip **36**, consisting of plexy glass, cellophane or a similar material suitable as carrier for sound grooves to be provided with matrices and unwound from the drum **35** and eventually a second matrix **8***a* for impressing the other side of the sound groove carrier **36** are supplied.

The two matrices **8** and **8***a* are moved towards each other and with the carrier **36** between same are, exactly guided by the guide members **37** and **37***a*, introduced between the rollers **38** and **39**, between which the impression of the groove webs **34** in the groove carrier **36** is effected. To facilitate the impressing operation, the rollers **38** and **39** are heated and maintained hot.

After effecting the impression, the now finished sound strip is wound upon the drum **40** and the matrices **8** and **8***a* are further moved to eventually effect further impressing.

The matrix may directly after or during the manufacture be listened to and this electromagnetically if the matrix is provided with reliefs, by scanning if the matrix has grooves by means of which profiles in relief are impressed which in turn are capable of being electro-magnetically scanned. All the profiles may be scanned during the production and opposed upon frequency meters in such a manner that differences in the exactness of reproduction are noticeable at once optically or accoustically by means of a measuring indication.

The final positive, therefore, may obtain a deepened impression or an impression in relief. The impression in relief is by means of modern printing methods for the matrix easily be worked with such sharp or exactly formed edges from the surface of the sound carrier that the groove between this upper surface and the flank of the impression may be scanned by a needle, provided an indented record has been impressed. An intensity record in relief and also the above mentioned indented record in relief may, furthermore, be rendered conductive with the use of known means and may then electromagnetically be scanned.

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3 Sheets-Sheet 1

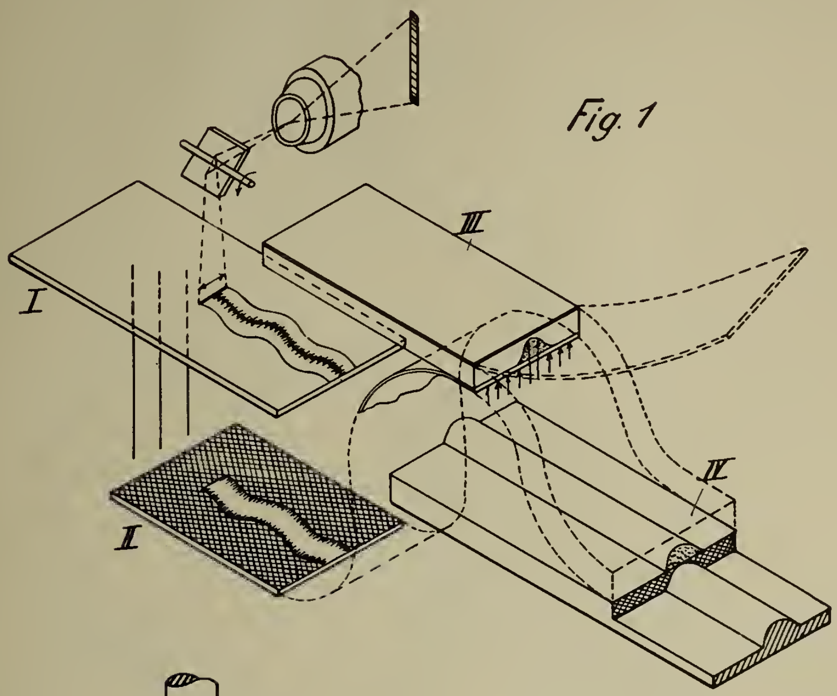

Fig. 1

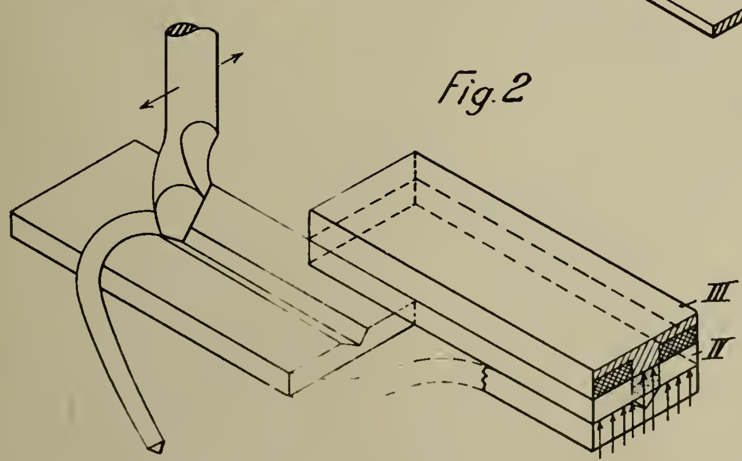

Fig. 2

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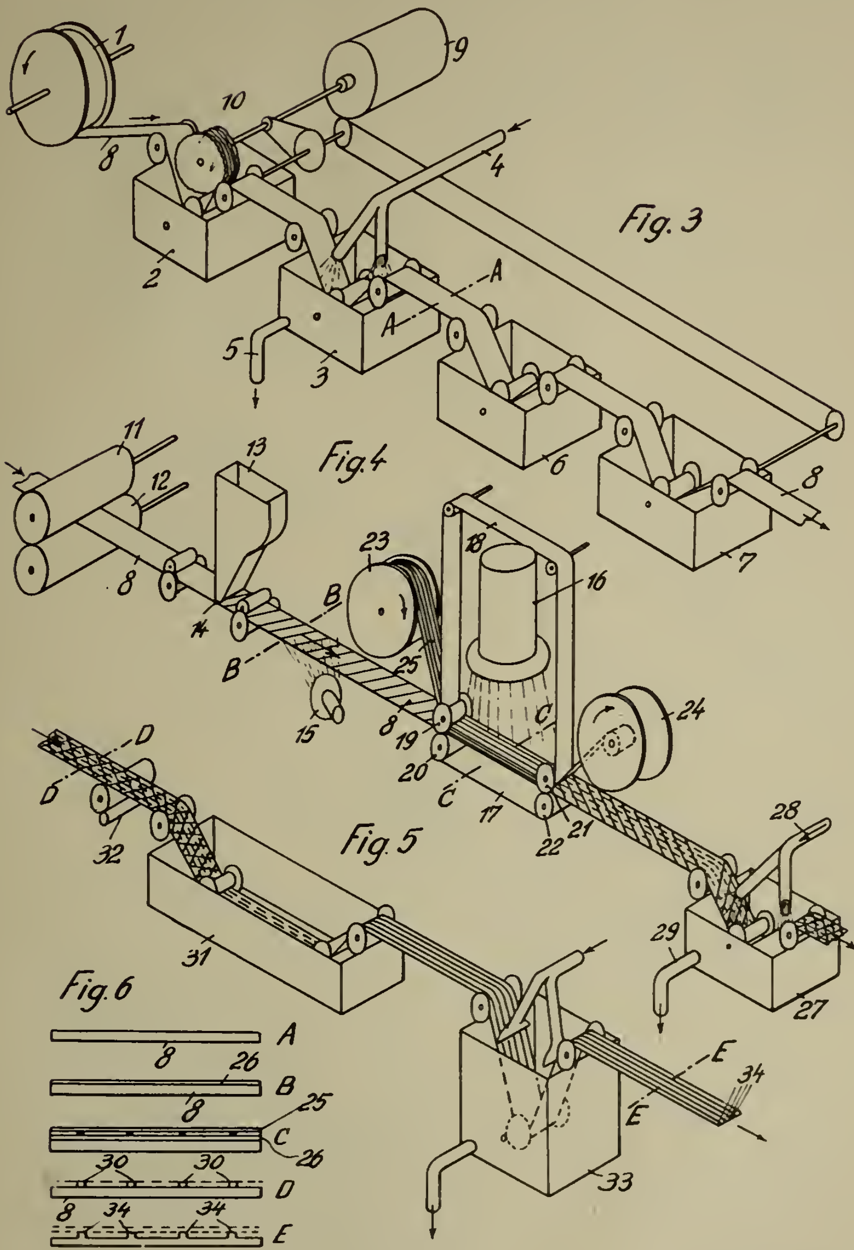

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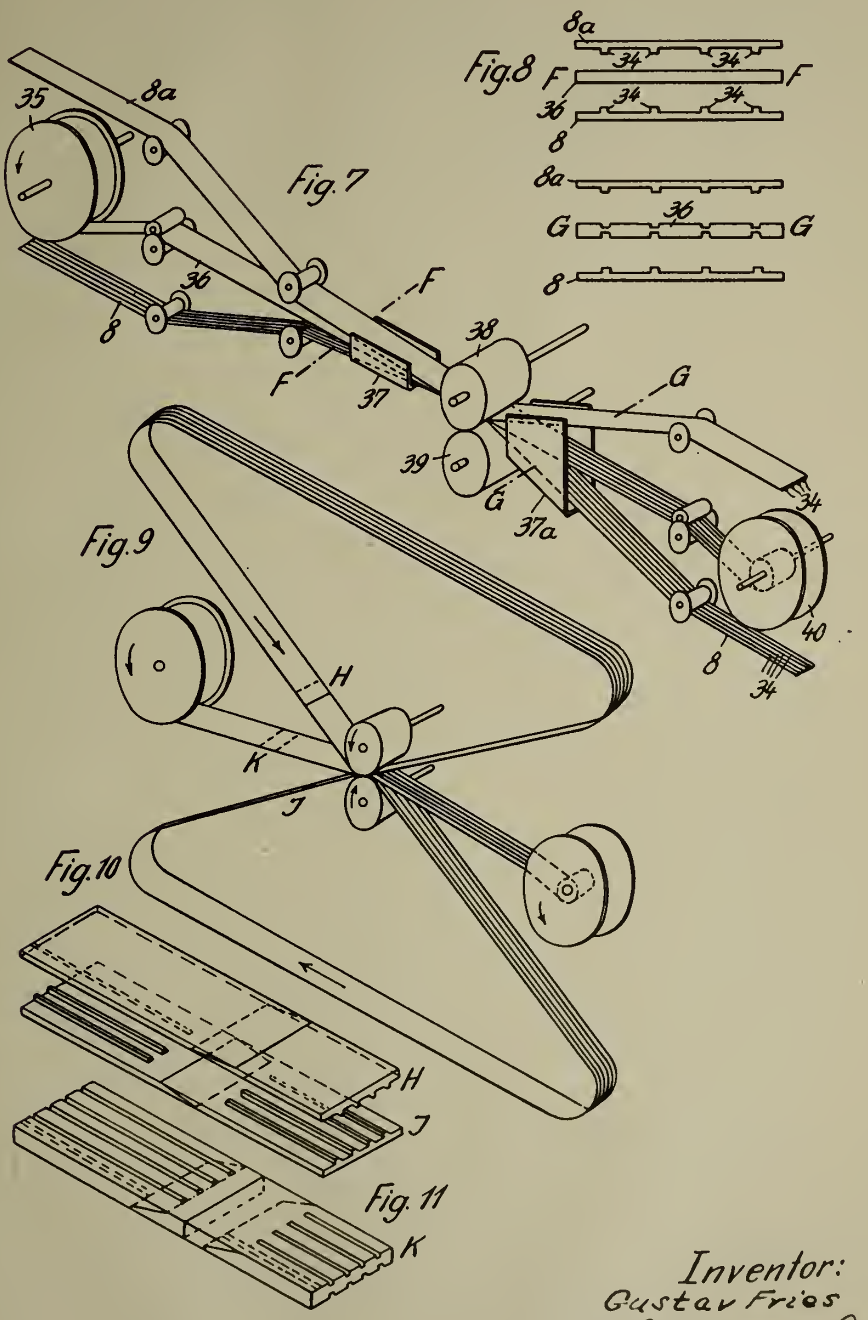

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